DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA 91125

A CASE STUDY OF REGULATORY PROGRAMS OF THE FEDERAL ENERGY ADMINISTRATION

W. David Montgomery

Published in Study on Federal Regulation, Appendix to volume VI, Framework for Regulation. U.S. Government Printing Office: Washington, D.C., December 1978.

SOCIAL SCIENCE WORKING PAPER 147

January 1977

SUMMARY

The Federal Energy Administration (FEA) is responsible for a comprehensive program of price controls and mandatory allocations that affect all levels of the petroleum industry. The program is intended to insulate the domestic economy from the effects of rising world oil prices and to protect the independent sector of the petroleum industry. FEA is also charged with achieving these primary goals with the least possible loss in economic efficiency.

During the summer of 1976 the price at which increased domestic crude oil production could be sold was limited to an average of $11.28 per barrel, while imported oil was costing about $13.50 per barrel. If that differential is continued to 1985, U.S. oil production may be 1 million barrels per day lower than it would be in the absence of controls. Because more expensive imports must be substituted for this lost production, oil costs would rise by about $500 million. Another FEA program, the "entitlements" program, causes the price of refined products to be based on the average rather than the incremental cost of crude oil. This system creates a subsidy to imports on the order of $3.00 per barrel. As a result oil demand is larger than it would be in the absence of controls; the stimulus to demand imposes an efficiency cost between $400 million and $2 billion per year.

From the point of view of energy consumers, the efficiency costs may be overwhelmed by the fact that crude oil price controls prevent about $15 billion per year from being transferred from consumers to energy producers. Other systems than price controls might be able to achieve similar income transfer with lower efficiency costs.

Gasoline and kerosene jet fuel remain subject to price control and allocation programs, while other refined products have been exempted from such controls. If the refining and marketing sectors of the petroleum industry are competitive, the crude oil price control and entitlements programs could be used to control prices of these products (and other) without imposing price ceilings on the products themselves. Consequently refined product price control and allocation programs confer no benefits on consumers in the aggregate, but serve to reduce the efficiency of resource allocation in refining and to distort the structure of retail markets. No quantitative estimate of overall efficiency loss has been made, since it would be the sum of many individual effects throughout the petroleum industry. One particularly disturbing aspect of the FEA's regulatory program is its express intent of keeping less efficient refiners and marketers in business despite the resulting economic cost.

Under current law, oil price controls are scheduled to expire in May 1979. However, the rate at which prices are allowed to rise will keep price ceilings well below market prices in 1979. Consequently, price controls are likely to be extended beyond 1979 unless the current law is changed. Elimination of price control and allocation programs would elimimate attendant efficiency losses, but at a substantial cost to energy consumers. Allowing price ceilings to rise sufficiently rapidly to achieve deregulation in 1979 could give consumers time to adjust to those higher costs.

If price controls were to be continued indefinitely, it would be possible to eliminate the restraint on oil production created

by the ceiling on prices of additional oil produced domestically. Eliminating that ceiling would cost consumers about $2 billion annually. Price controls on gasoline could also be eliminated at no cost to consumers and a considerable gain in efficiency.

A third alternative is the replacement of price controls with an excise tax on domestic oil production. Such a tax would prevent the transfer of wealth from energy consumers to energy producers without the stimulus to demand created by price controls. It would raise energy prices, but purchasing power lost in consequence could be restored if receipts from the exise tax substituted for other sources of government revenue.

I: HISTORICAL BACKGROUND

Controls on oil prices have existed, with one brief hiatus, since President Nixon announced the wage-price freeze that began the Economic Stabilization Program on August 15, 1971. However, controls designed specifically to deal with rising oil prices were not instituted until the summer of 1973. At that time the Cost of Living Council developed a system of controls which have evolved rapidly but with little fundamental change into the current program.

Problems perceived in 1973 included rapidly rising gasoline and home heating oil prices; a "squeeze" on independent refiners who were finding crude oil difficult to obtain; and the rapid disappearance of independent, low price gasoline retailers. To deal with some of these problems a voluntary allocation program was also instituted during the summer of 1973.

Before the Cost of Living Council's price controls were three months old, the Arab oil embargo began and the price of available imported oil began to rise. In response to those events, Congress passed the Emergency Petroleum Allocation Act of 1975 (EPAA), which brought together price control and allocation programs. Responsibility for those programs was delegated to the Federal Energy Office, later the Federal Energy Administration.

After a series of temporary extensions, the EPAA expired in December 1975. It was extended by the Energy Policy and Conservation Act (EPCA), which rolled back oil prices but provided a mechanism through which those prices would gradually be allowed to rise. The

EPCA was passed at a time when it was believed that allowing oil prices to rise suddenly, as they would if price controls lapsed, could plunge the economy back into recession. The EPCA was amended in August 1976 to allow more rapid escalation of oil prices.

THE SITUATION FROM AUGUST 1971 TO AUGUST 1973

Conditions at the Inception of Price Controls

Congress passed the Economic Stabilization Act in August 1970; that act empowered the President to impose sweeping economic controls. Between January and August 1971 the consumer price index increased at an annual rate of 3.8 percent, a substantial decline from 6.1 percent inflation experienced during 1969. In August 1971 output and employment were in the early stages of recovery from recession, although the unemployment rate was still 5.9 percent in the last quarter of 1971.

In mid-1971 the Administration saw signs that price indices might be starting to rise again: after a peak in 1969 and a trough in 1970, all price indices were slightly higher in the second quarter of 1971 than they had been at the bottom of the trough.[1]

In response to this situation the President announced the Economic Stabilization Program--which lasted from August 15, 1971 to April 30, 1974. On August 15, 1971, President Nixon exercised powers granted in the Economic Stabilization Act of 1970 to impose a ninety day freeze on all wages and prices ("Phase I"). The freeze was followed, on November 14, by a set of comprehensive regulations designed

to prevent price increases anywhere in the economy from exceeding an annual rate of 3 percent ("Phase II"), which lasted until January 11, 1973.

Conditions in the petroleum industry or energy markets had little to do with the initial price control system imposed on the petroleum industry. During Phase I and Phase II the purpose of controls was to combat general inflation, caused in large part by previous monetary and fiscal policy. The petroleum industry was not seen as posing a special inflation problem, and it was not singled out for special treatment until 1973.[2]

The Changing Oil Market

During Phase I and Phase II a number of changes were occurring in the domestic and international oil industry. Until 1970 the structure of the U.S. petroleum industry was keyed to the existence of large supplies of crude oil at stable prices. During the 1960's domestic crude oil became increasingly expensive relative to foreign crude oil, especially that imported from the Middle East. To control imports an oil import quota had been in existence since 1959. The quota was implemented by issuing import tickets that entitled the holder to import oil. Although the tickets would not be sold for cash, they would be traded by means of crude oil exchanges. The terms of those exhanges implied that during the 1960's the value of import tickets was as high as $1.25 per barrel--indicating that imported oil was that much less expensive than domestic.[3]

Beginning in 1970, a number of world events combined to

reduce the availability and increase the cost of foreign oil. Political tensions in the Middle East led to the closing of the Trans-Arabia Pipeline and reduction of exports from Libya. To substitute for these sources of oil, it was necessary to send more tankers around the Cape of Good Hope to the Persian Gulf.

Later in 1970 the members of the Organization of Petroleum Exporting Countries began to demand increased prices for their oil. Between February 1969 and February 1972 the landed cost of one type of foreign crude oil increased 33 percent. Table 1 exhibits some trends in international oil prices.

The results of these events was a change in the basic determinants of domestic oil prices. During the sixties a quota limited crude oil imports, which were available at a price of about $1.50 per barrel. The price at which demand for crude oil equalled domestic plus imported supply was, at that time, above $2 per barrel. Because imports were limited by the quota, any change in demand for crude oil resulted in a change in domestic production. Consequently the incremental cost of oil, on which the domestic price was based, equalled the cost of increasing domestic supply by one barrel. During the sixties domestic production costs determined domestic prices.

By 1973 domestic demand for crude oil had increased sufficiently that when the import quota was removed, the price of imports determined domestic crude oil prices Despite the higher price of imported crude oil the amount of oil that could be produced domestically at a cost less than the cost of imports fell far short of demand. Consequently oil imports represented the least expensive source of

Table 1

KEY WORLD CRUDE OIL PRICE POSTINGS - 1970-1974
(Dollars per Barrel)

Source	8/31/70	2/15/71	1/20/72	1/1/73	8/1/73	10/1/73	10/16/73	1/1/74
Persian Gulf								
Arab Light	1.80	2.18	2.48	2.59	3.07	3.01	5.12	11.65
Iran Heavy	1.63	2.13	2.42	2.53	2.99	2.94	4.99	11.64
Abu Dhabi - Murban	1.88	2.44	2.54	2.65	3.14	3.12	6.05	12.64
Kuwait	1.59	2.09	2.37	2.48	2.94	2.88	4.90	11.55
African								
Libya	2.18	2.55	3.67	3.78	4.58	4.60	8.93	15.77
Nigeria	2.17	2.42	3.45	3.56	4.29	4.29	8.31	14.69
Wnatran Light	1.70	1.70	2.26	2.96	3.73	4.75	4.75	10.80
Venezuelan -Oficina	2.34	2.34	2.79	3.09	4.62	5.45	5.45	14.88

Source: Petroleum Intelligence Weekly, March 25, 1974

Source: FEA: Project Independence Final Task Force Report on Oil, p. II-5

additional oil supplies, and the world price of oil determined all domestic crude oil and petroleum product prices. That price was set unilaterally by OPEC, supported by production restrictions, and rising rapidly.

By 1971 U.S. dependence on foreign oil supplies had become firmly established. According to FEA,

> Exploration, drilling, proved reserves, and production in the United States grew rapidly for ten years following World War II. By 1958 the combination of domestic success and rapid growth in oil imports produced a surplus in production capacity ...[M]ore than 3.5 million barrels a day of production capacity stood idle in 1964.
>
> Exploration and development declined after ... 1956, because of discouraging prices, prorated production, and diminishing prospects for exploration compared to the attractive opportunities abroad. This decline was unaffected by the resumption of strong growth in demand after 1965 ... The domestic surplus diminished rapidly and disappeared altogether by 1971, forcing the nation to rely entirely on foreign supplies for nearly all of its new supplies of petroleum.[4]

U.S. reliance on foreign sources began, unfortunately, at a time when foreign sources were limiting supplies to obtain higher prices:

> Venezuela, Kuwait, and Libya ... imposed limits on their production well before the Arab-Israeli War of October, 1973. By early 1973 the historic [world] surplus of crude oil had disappeared, supplies were right, and three-fourths of the increase in demand over the previous year was being supplied by Saudi Arabia, Iran, Iraq, and Abu Dhabi.[5]

Simultaneously, increasingly stringent air quality regulations encouraged refiners to reduce the amount of sulfur contained in their refinery products. Two ways of reducing sulfur content exist: obtaining low sulfur crude oil or removing sulfur during refining. Until refiners could add equipment for removing sulfur from crude oil, demand for low sulfur crude oil was greatly increased. With this increased demand supplies of low sulfur crude became particularly tight, and the tanker shortage was exacerbated because longer voyages were required to obtain low sulfur crude.

Between the mid-sixties and 1973 there also was essentially no new construction of oil refineries in the United States. Uncertainty about supplies of crude oil because of the oil import program is cited as a major reason for this stagnation.[6] In the 1960's the refining industry had considerable excess capacity, but by 1972 and 1973 it was operating at close to capacity.

The capacity constraint was particularly severe in regard to the facilities needed to process and clean high sulfur crude oil. The combination of reduced supplies of low sulfur crude oil and limited facilities to process high sulfur crude combined to exacerbate the generally tight condition of petroleum markets.

The Changing Structure of the Oil Industry

By mid 1973 there was widespread concern, based on some real market forces and trends, that the position of independent gasoline marketers was being threatened. Because of the less visible connection between independent refiners and ultimate sales of petroleum products to consumers, concern about the position of independent refiners was genuine but less pervasive.

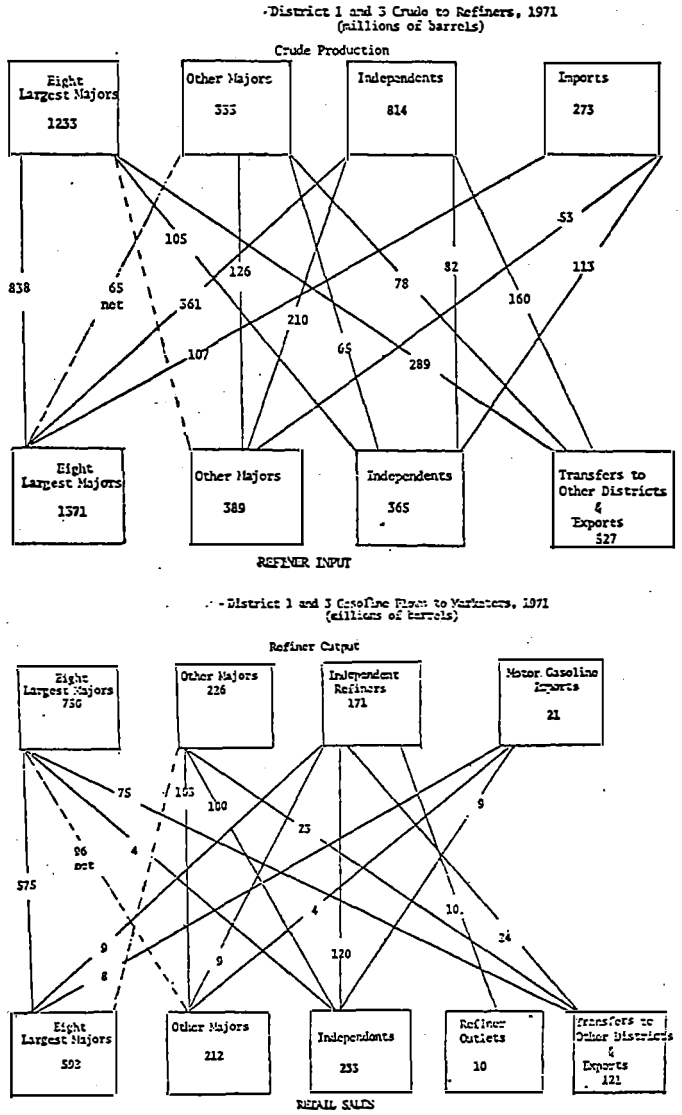
To describe the evidence regarding independents' market shares it is necessary to digress into definitions. The term "independent" is ambiguous when used in describing oil companies, and the place of independents in the oil industry is exceedingly complex. Figure 1 depicts the typical pattern of crude oil and petroleum product flows between the various segments of the industry.

The petroleum industry is commonly divided into three levels: oil production, refining, and marketing. The major, integrated oil companies[7] exist at all levels, producing crude oil, refining it, and selling products. The majors sell gasoline and other petroleum products directly to the public, through company owned and operated stations, to branded independent dealers who own or lease their stations but sell under the brand name of the major, and to dealers that resell gasoline under their own brand name. The major integrated companies also trade oil and refined products among themselves (and with small and independent refiners). To be classified as a major integrated concern a company must have substantial activity at all levels of the industry and must be large.

Some refiners commonly classified as independent actually produce much of their own crude oil; others have substantial control over ultimate marketing. They are differentiated from majors either by size or by being active in no more than two levels of the industry.

Independent crude oil producers sell to major, integrated refiners and to independent refiners that control little or no crude oil of their own. Independent refiners obtain about one-half their crude oil inputs from the major oil companies. They sell gasoline

Figure 1
Patterns of Transactions in the Petroleum Industry



NOTE.—Dashed lines indicate net sales of the largest majors to other majors and of other majors to the eight largest. Total sales of the eight largest majors to other majors and sales of other majors to the eight largest were not available.

Source: Preliminary Federal Trade Commission Staff Report on its Investigation of the Petroleum Industry.

and other products in the same fashion as the major integrated refiners: through company owned stations, through retailers who own or lease stations but sell under the refiner's brand name, and to independent resellers that market under their own name. These independent, "unbranded" resellers depend about equally on independent refiners and on major, integrated refiners for gasoline. Independent refiners sell little gasoline to major brand outlets.

The share of "independents" varies with the industry sector chosen and with the definition of "independent." At the refinery level it is possible to refer to only two groups -- the major, integrated refiners and all the rest - the "small and independent refiners" referred to in the EPAA.[8] But some large independent refiners differ only marginally from some majors, while some small refiners own nothing but one refinery one-tenth the size of a typical single refinery in a major multi-refinery operation. The average capacity of a refinery owned by a major, integrated refiner is 100,000 barrels of crude oil input per day; each major company owns an average of 5.4 refineries. The average capacity of an "independent" refinery is 20,000 barrels per day; most independents own only one refinery.[9]

There are some economies of scale in refinery operation. Unit costs decline as a refinery becomes larger, with no apparent limit. In a recent study M. Adelman cites 100,000 barrels per day as the minimum efficient size for a refinery.[10]

All of the independent and most of the small refiners rely heavily on supplies of crude oil from sources outside the company. When there were ample supplies of crude oil, all independent

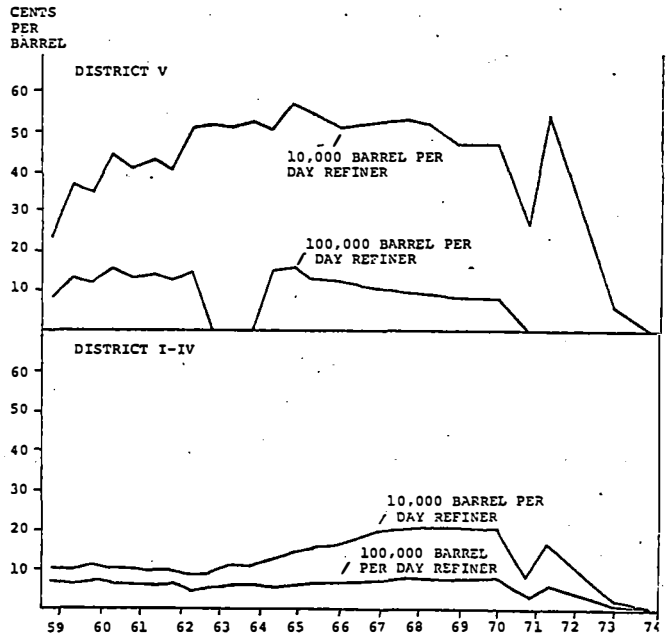
refiners had access to crude oil at stable prices. Under the surplus conditions that existed until the seventies, it was also possible for refiners that lacked their own sources of crude oil to shop around for crude oil and, by frequently taking advantage of a buyer's market, obtain crude oil at an average cost lower than that of an integrated operation.[11]

In addition, small refiners (100,000 barrels per day of capacity or less) received preferential treatment under the oil import program by means of a disproportionate allocation of import tickets. All of these factors added up to a cost advantage in obtaining crude oil that made it possible for small refiners to compete with majors even though in general small refineries were technically less efficient than the large operations run by the majors.[12]

As the value of import tickets fell to zero in the early seventies the small refiner preference disappeared.[13] (See Figure 2). Simultaneously, some small and independent refiners found they were no longer able to purchase crude oil from major, integrated oil companies as readily as during the period of crude oil surplus. According to John Hill, during 1973 "major refiners, seeing that they were going to need crude for their own refineries ... began to curtail supplies ... to independents."[14]

Price controls during the early stages of the Economic Stabilization Program (before passage of the EPAA) were probably responsible for further restricting independent refiners access to crude oil. With price controls,

Figure 2
Subsidy to Small Refiners Under Support Control Program



Source: Testimony of John Hill, Sept. 5, 1975, p. 172.

> "[s]ellers of the commodity are faced with potential customers willing to purchase more output at the ceiling price than the seller can profitably produce. The seller in this situation may exercise discretion over which of the willing buyers he decides to supply without any adverse effect on his profits. Given such discretion when the government ceiling price was below the free market price, integrated firms had a natural incentive to supply their own outlets in preference to independent firms ... By doing so, they may have done some damage to their competitors at no cost to themselves. And they may even have been able to exploit loopholes in the regulations to boost indirectly the price of their product as it passed through the company's vertical structure. Price controls therefore, in removing much of the incentive which major firms had to supply independents, made it more difficult for independents to obtain supplies than would have otherwise been the case."[15]

Evidence of the problems of independent refiners in 1973 is found in the higher capacity utilization rates among major antegrated refiners than among independent refiners.[16]

The existence of excess refining capacity prior to 1972 also made the integrated refiners willing to sell gasoline to independent marketers at a lower price than that charged to their branded dealers. Throughout the sixties investment planning was based on the assumption that a new refinery would operate at 70 to 80 percent of capacity. Production in excess of 80 percent of capacity could be sold profitably at a cost little greater than the cost of crude oil, if all capital charges were applied to the prices of the first 80 percent of capacity output. It is claimed that major refiners established such a system, charging higher prices for branded

gasoline and lower prices for gasoline sold to independent, unbranded marketers.[17]

In addition, marketers of "unbranded" gasoline were often able to make "spot" purchases of gasoline from major refiners unwilling to store production in excess of current demand from their own dealers. That arrangement benefited both parties: major who found that branded retailers were taking less of their refinery output than anticipated could sell rather than store their excess output, while independent purchasers obtained supplies of gasoline at considerably lower prices than were charged major-brand dealers.

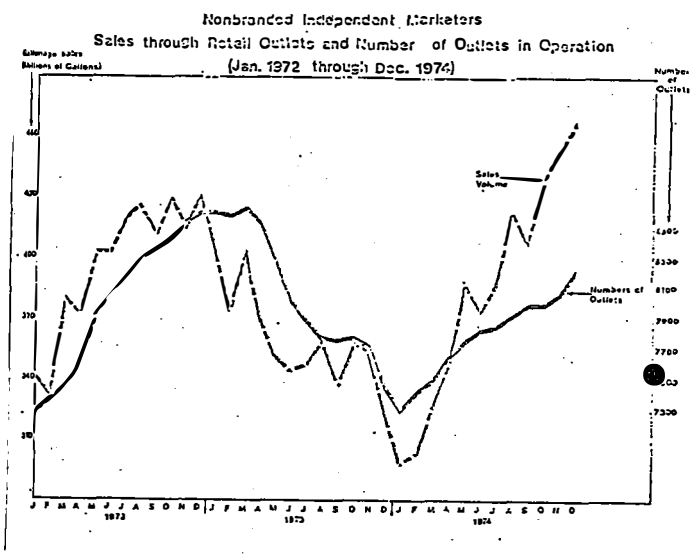
These opportunities to buy cheap gasoline were removed when refineries reached full capacity in 1972 and 1973. To be more precise about the changing fortunes of independents in gasoline marketing requires examination of several different types of independent operation.

The narrowest definition of independent marketer would include only those gasoline stations not owned by a refiner and not selling under a brand name. That sector of the gasoline marketing industry clearly increased in size during 1972 and declined in size during 1973[18] (See Figure 3). Its market share followed the same pattern.[19]

One FEA report attributes this decline to a decline in gasoline supplied by small and independent refiners who supplied 60 percent of the gasoline sold by unbranded independents. It states that

... declines [in sales of nonbranded gasoline] occurred

Figure 3



Source: Testimony of John Hill. September 5, 1975, p. 167

> at the same time that total gasoline sales declined for large independent and small refiners. In the third quarter of 1973 (when total nonbranded gasoline supplies reached their lowest point of decline) the supplies of large independents and small refiners were only 81 and 78 percent, respectively, of 1972 base quarter levels.[20]

Those independent marketers that depended on spot sales of gasoline clearly suffered a substantial decline in market share between 1972 and 1974.[21] Smaller changes in market shares for independents as a whole probably indicates that most independent marketers were purchasing gasoline under more stable arrangements.

PRICE CONTROLS - JANUARY TO AUGUST 1973

As these changes were taking place in the structure of the petroleum industry changes were also occurring in oil price controls.

Phase III of the Economic Stabilization Program, which began on January 11, 1973, replaced the mandatory price controls of Phase II with a system of voluntary restraint on price increases -- a system which could revert to mandatory controls on specific industries if prices rose excessively. During January and February home heating oil prices increased sharply. Hearings held by the Cost of Living Council -- responsible for Phase III price controls -- established that those price increases were within Phase III guidelines. Apparently the hearings also revealed problems in the petroleum industry. A Cost of Living Council staff paper prepared after the hearing described conditions in the petroleum industry.

> A classic demand pull situation exists in the oil industry ... Demand is rising rapidly and supplies of petroleum products are inadequate to meet demand. Additional supplies are not readily available in sufficient quantities at current prices and production is at roughly full capacity.[22]

The paper recommended mandatory controls that would allow the oil industry some flexibility to respond to market conditions but restrain price increases to a level consistent with the "integrity of the Economic Stabilization Program..."[23]

On March 6,1973, the Cost of Living Council issued Special Rule Number One, imposing price controls on the oil industry alone. Thus it was only well into Phase III that the oil industry was singled out for special treatment.

Special Rule No.1 "reimposed mandatory controls on the sale of crude oil and petroleum products for firms with annual sales of $250 million or more. (The 24 firms covered by the special mandatory rule accounted for 95% of industry gross sales.)"[24] Because the 24 largest firms were effectively prevented from increasing product prices by more than an average of 1.5%, Special Rule No. 1 created a two-price system at every level of the petroleum industry.

The purpose of Special Rule No.1 was, according to the CLC, "to provide an orderly system under which the inflationary pressures from rising crude and petroleum prices could be balanced against the need for sufficient pricing flexibility to insure adequate supplies."[25] The flexibility provided by Special Rule No. 1 lay in adjusting the relative prices of different petroleum products while maintaining restraint on average price increases. However, Special

Rule Number 1 did not succeed in its objective of controlling gasoline and home heating oil prices, which rose at a rate considerably larger than the general Phase III target of 1.5 percent.[26]

The increases were in large part driven by increases in the price of imported oil described in Table 1 and by uncontrolled refiners bidding up domestic crude prices. The uncontrolled segment of the oil industry was able to increase its own prices and to buy products from major oil companies at controlled prices and sell them at uncontrolled prices. In retrospect, the exemption of small firms from regulation appears to have been responsible for the failure of Special Rule Number One to control prices.[27] However, its failure to provide real incentives to expand domestic production may have doomed it anyway.

It has been claimed that Special Rule Number 1 also exacerbated the difficulties forcing the independent sector of the industry. William Johnson has observed that "[O]ne way the majors could increase profits under Special Rule Number 1 without increasing prices was to switch gasoline and distillate from spot-market to regular customers and from bulk to retail purchasers", thus switching the products to markets with higher price ceilings.

Johnson also claims that even in those markets majors were compelled to undersell independent marketers "whose niche in the industry was based on price-cutting".[28]

On June 13 President Nixon again froze all oil prices and directed the Cost of Living Council to develop Phase IV regulations that would "stabilize... the price of gasoline." Phase IV took

effect on August 14, 1973. Current FEA price regulations derive directly from the Phase IV regulations instituted by the Cost of Living Council. Under Phase IV price increases were allowed, but only to pass specific, allowable cost increases through to consumers. However, the basic price structure was designed to stimulate additional domestic oil production, which was seen as the only long-run solution to inflationary pressure from the petroleum industry.

The Cost of Living Council created a two-tier price system for all domestic crude oil. Imported crude oil was exempt from controls. "Old" oil was defined as oil produced from a property -- roughly the same as a lease tract -- in quantities less than 1972 production levels on that property. The price of old oil was set at the posted price in effect on that field on May 15, 1973, plus $1.35 per barrel. That rule resulted in an average price of old oil of about $5.00.

Crude oil produced in excess of 1972 production levels from the same property ("new oil") and oil from properties that averaged less than 10 barrels per well per day was exempt from controls. In addition, each barrel of new oil produced "releases" one barrel of old oil from controls. By December 1975, uncontrolled oil was selling at a price of about $13 per barrel. This price control system is described and evaluated in detail in subsequent sections.

During the Spring of 1973 the apparent shortage of crude oil and products and concern about the independent sector also led to development of an allocation program for the petroleum industry.

In April 1973 Congress enacted the "Economic Stabilization

Act Amendments of 1973", which included authority to order mandatory allocation of gasoline and other petroleum products. A voluntary program was created on May 10, 1973, with two purposes: to alter the geographical availability of petroleum products and to halt the erosion in the position of the independent refiners and marketers who were having difficulty locating supplies.

AUGUST 1973 to DECEMBER 1975

The Emergency Petroleum Allocation Act

In October, 1973 the Organization of Arab Petroleum Exporting Countries (OAPEC) announced a reduction of crude oil supplies to countries supporting Israel, cutting off about one-third of U.S. oil imports at the height of the embargo.

On November 27, 1973, Congress enacted the Emergency Petroleum Allocation Act of 1973 (EPAA), which brought the allocation program and the price control program together.

In Section 2 of that Act, Congress determined that "shortages of crude oil, residual fuel oil, and refined petroleum products caused by inadequate domestic production, environmental constraints, and the unavailability of imports sufficient to satisfy domestic demand now exist or are imminent" and that "such shortages have created or will create severe economic dislocations and hardships."

The EPAA directed the President to "promulgate a regulation for the mandatory allocation of crude oil, residual fuel oil, and each refined petroleum product ... and at prices specified in ... such regulation."[29]

Those price controls also had the clear purpose of preventing windfall profits to energy producers that would result from domestic oil prices rising to the price of imported oil, and of transferring those potential profits into the hands of consumers as lower energy prices.

The Emergency Petroleum Allocation Act was conceived as a temporary measure designed to cope with a sudden drop in petroleum supplies. The reason for the legislation was stated in the Conference Report as

> ... the conferees are in unanimous agreement that due to various factors the self-regulatory laws of supply and demand are not currently operating in the petroleum market. It is imperative that the Federal Government now accept its responsibility to intervene in the market place to preserve competition and to assure an equitable distribution of critically short supplies.[30]

The report emphasized the allocation of petroleum products to priority uses, but also mentioned that

> ... this legislation requires the mandatory allocation program to be so structured as to prevent major oil companies from inequitably restructuring crude production for their own use or from favoring their directly-owned outlets over independent products.[31]

The House report on the EPAA reiterated the intended temporary nature of the allocation program. It stated that the EPAA

> ... is not designed to increase[e] supplies ... The shortage problem is the result of policies which have been in effect over a number of years, and it awaits a more far reaching and long range solution. Instead, this bill focuses on the short term objectives of seeing to it that during times of shortage our priority needs are met and that whatever limited supplies

we have are equitably distributed throughout the nation to meet regional needs and preserve competition in the marketplace.[32]

Objectives of the allocation program were specified in terms of the uses of petroleum products and the structure of the petroleum industry. Uses to be awarded high priority were those sustaining "public health safety and welfare (including maintenance of residential heating,...) and the national defense; ... maintenance of all public services ...; [and] maintenance of agricultural operations..."[33]

The House report emphasized the need to use the allocation system to protect the competitive position of independent distributors and dealers of gasoline:

> Witnesses ... testified that over 2000 independent marketers of gasoline had been forced out of business by July of [1973]...
>
> Some have suggested that the gasoline shortage has been continued by the major oil companies to purge from the business their only significant competitors, the independent, non-branded dealers. The Committee does not have the means of assessing the truth of that allegation, but -- whether intended or not -- this clearly has been the result.[34]

Allocation of crude oil at the refinery was described in the reports as having two purposes: 1) "to assure the maximum utilization of refinery capacity," in particular by providing supplies of low-sulfur crude oil to refineries unable to process high sulfur oil, and 2) to adjust the mix of products being produced in U.S. refineries "so as to assure accomplishment of the Congressionally stated objectives."[35] The Committee believed that by directing crude oil toward refineries producing relatively more of desired products, the President could cause changes in the product mix. In other places, the EPAA stated the

objective of "preserving the competitive viability of independent refiners,"[36] which might also be pursued through crude oil allocation at the refiner level.

The EPAA was not, however, intended to establish a prolonged alteration of the structure of the petroleum industry. The House Report stated that

> If the current distress of independent refiners, branded independent marketers, and non-branded independent marketers is subsequently shown to reflect a permanent shift in competitive advantage in favor of the large integrated oil companies, it may be in order for Congress to consider remedies in the field of tax, import, and anti-trust policy. However, the direct allocation program established pursuant to this bill is not for the purpose of permanently reforming the structure of enterprise or incentives in the petroleum industry.[37]

Price controls were authorized as an adjunct to the allocation program. The conferees stated that pricing authority was "included on the premise that it does no good to require the allocation of products if sellers are then permitted to demand unfair and unrealistic prices."[38] They continued that "reference to equitable prices is specifically intended to emphasize that one of the objectives of the mandatory allocation program is to prevent price gouging or price discrimination which might otherwise occur on the basis of current shortages."[39]

Coping with inflation was not mentioned as a purpose of price controls. The Congress had no foreknowledge of the increases in prices of imported oil that would be demanded by OPEC during and subsequent to the embargo.

Terse mention was made of "economic efficiency" and "minimization of economic distortion, inflexibility, and unnecessary interference with market mechanisms" as objectives of the mandatory allocation program.[40]

The price control and allocation authorities granted in the EPAA were scheduled to expire on August 30, 1975. During the summer and fall of 1975 Congress faced a decision regarding extension of controls.

THE ENERGY POLICY AND CONSERVATION ACT

When the Energy Policy and Conservation Act (EPCA) was befor Congress in the fall of 1975, attention had shifted from dealing with an acute shortage to dealing with the consequences of the high price of imported oil. Between August 1973 and June 1974 the price of imported crude oil rose by about 400 percent. Despite price controls on domestic crude oil, this precipitate increase in the average cost of crude oil caused substantial increases in the cost of petroleum products to consumers. Those price increases were in turn seen by many economists as partially responsible for plunging the economy into a deep recession during 1974 and 1975. Otto Eckstein, for example, stated that

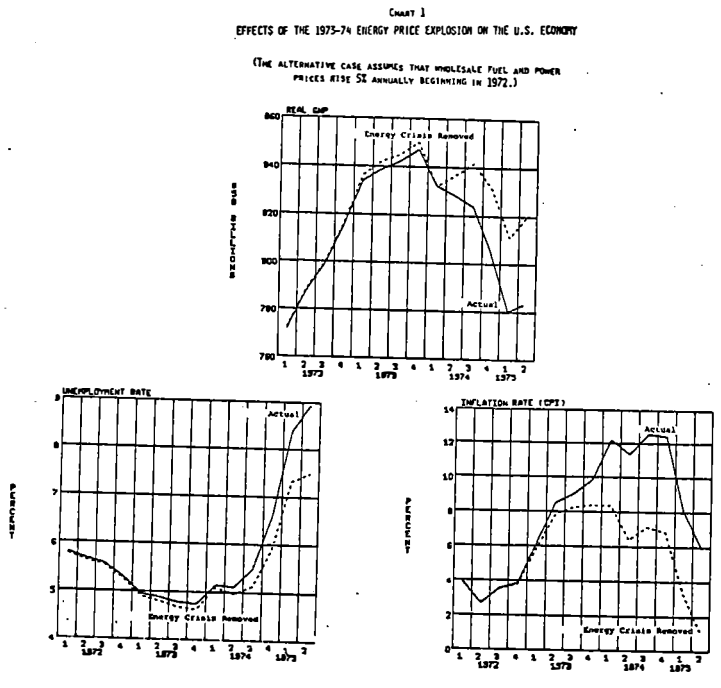
> The Vietnam War, faulty policies, and food were major causes [of the current economic crises]. But the oil embargo and quadrupling of OPEC prices were the biggest single factors. Chart 1 contrasts the path the economy would have followed with and without the energy difficulties, all other troubles occurring,... [T]here would have been a serious recession and inflation, but nothing of the severity actually suffered."[41]

The Chart to which Eckstein referred is reproduced as Figure 4. Similar conclusions emerged from a series of papers commissioned by the Brookings Institution,[42] and were echoed in the debate on the EPAA. By late 1975, recovery from recession was underway. However, price controls still held energy prices well below their market level; allowing controls to lapse, and prices to rise rapidly, could abort the recovery.

The report that accompanied the House version of the bill that became the EPCA spelled out two reasons for the continuation of oil price controls: protection of low and middle income consumers from the impact of energy price increases and mitigation of the macroeconomic impact of a sudden increase in energy prices. The report explicitly rejected the use of higher energy prices to achieve energy policy goals:

> The Committee would also agree that ... as prices increase, consumers of energy will either use less energy or use energy more efficiently. At the same time, producers of energy would be encouraged to make additions to supply ... But the Committee believes these effects cannot be achieved in the short term ... the Administration's own analyses demonstrate that higher prices will not elicit marginal additions to supply of any truly significant amount in the next three to five years. And the measure of these marginal additions to supply cannot possibly justify the burden borne by the entire economy in the interim period.[43]
>
> In particular, the Committee finds the President's strategy to use price as the principal means of achieving conservation unacceptable because it so harshly impacts on the poor and low

Figure 4



Source: Testimony of Otto Eckstein, September 5, 1975, p. 333

> income members of our society ... the percentage of family income spent on energy declines significantly as income increases.[44]

The report also referred to macroeconomic conditions, stating that

> The Committee's Subcommittee on Energy and Power's own analysis shows that abrupt decontrol of energy prices coupled with a further increase in OPEC prices could devastate any hopes for economic recovery and could produce an additional half-million unemployed.[45]

Phased decontrol over a 25-month period was also rejected. The Committee cited a Congressional Budget Office Study of June 30, 1975, which stated "that increases in energy prices projected to result from the President's 25-month phased decontrol of oil prices when coupled with an assumed increase in the OPEC price in October would rekindle inflation and significantly retard recovery from recession."[46] Similar sentiments were expressed by the Senate Budget Committee Task Force on Energy:

> The Task Force believes that macroeconomic and energy policy must be integrated. It rejects ... immediate decontrol with tariffs and excise taxes. The Task Force recommends phased decontrol a price ceiling on new oil (with exclusions,)...[47]

In Senate hearings on oil price decontrol, Otto Eckstein of Data Resources Incorporated testified that his econometric analyses reached the same conclusion:

> In summary, I strongly urge this Committee to help protect the incipient recovery by averting instant decontrol and working with the Administration to achieve a compromise phase-out of controls instead. It is time for all of us to be careful to let our economic machine resume a healthy growth process. We should minimize the shocks that have done so much damage and instant decontrol is another one of those.[48]

The mechanism by which decontrol of prices could increase unemployment -- as well as increasing inflation -- and thus retard recovery was described by the Congressional Budget Office.

> Higher energy prices raise the cost of virtually every commodity and service consumed. Given the well-established tendency for wages to rise with prices, these energy cost increases probably would initiate a wage-price spiral...
>
> Since consumers cannot easily reduce their use of gasoline or heating oil when the price rises, higher fuel prices force consumers to spend more of their incomes on energy. This leaves less income to spend on other goods and services so the demand for other products drops and real output and employment fall. Offsetting this impact is the increased flow of profits to oil companies, which would result from the decontrol of oil prices. If these funds were then spent on goods and services, the employment-reducing effects of higher oil prices would be largely offset ...
>
> Overall, it seems safe to assume that during 1976 and 1977 the loss of purchasing power of consumers would reduce total spending by far more than the increased flow of funds to oil companies would increase it. Much of the drop in aggregate demand would be temporary, but "temporary" in this context could mean two or three years.[49]

CBO's estimates are representative of Congressional understanding of the effects of decontrol at the time. CBO stated that "decontrol would add just under 0.5 percentage points to the inflation rate during the last quarter of 1975, just over 1 percentage point to the 1976 inflation rate, and about 0.25 of a point to the 1977 inflation rate ... The unemployment rate, projected as falling very slowly during 1977 even without decontrol, would stay practically unchanged at a level above 7 percent if immediate decontrol took

place."[50] The conclusion CBO reached was that gradual decontrol would delay the effects of higher consumer prices of energy to a time when the recovery was stronger and better able to cope with the shock.

In passing the EPAA, Congress expressed a clear intention of protecting the independent sector of the petroleum industry. No such sentiments were expressed in the Conference Report on the EPCA although the Act did require that the competitive structure of the industry be considered if removal of price controls were proposed.

The EPCA provided for continued price controls, on crude oil and refined products, and mandatory allocation through 1979. It required the FEA to revise the structure of crude oil price controls and allowed FEA to increase crude oil prices and exempt certain classes of refined products from price controls, subject to Congressional approval. The regulatory program developed subsequent to the passage of the EPCA is described and evaluated in detail in later sections.

The life of the Federal Energy Administration, created to administer the price control and allocation programs mandated by the EPAA, was not coterminus with the EPAA. Congress faced the question of extending the life of FEA in the summer of 1976, and took the opportunity to amend the price control authority granted in the EPCA.

The Energy Conservation and Production Act (ECPA), signed into law on August 14, 1976, extended the life of the FEA and made further changes in the nature of petroleum price controls. The Conference Report on ECPA spelled out the reasons why a faster pace of decontrol than allowed by the EPCA was justified. According to the

Conferees, "1975 was a year of continuing poor economic condition... [b]ecause the economy had not yet adjusted to the price increases of 1973-1974, it could not be expected to bear further price increases ..."[51] Consequently, EPCA was based on "the recognition of the justification and need for future price increases tempered by a procedure which allows these increases to be absorbed by the economy without undue economic disruption. This procedure provides the necessary weaning of the Nation from a low-cost energy based economy to one based on substantially higher-cost energy."[52]

The ECPA made changes in oil pricing policy that were based on a reassessment of macroeconomic conditions. The Conferees stated that the "dramatic change in the inflation rate [to 3 precent in mid-1976] itself evidences the ability of the economy to absorb more substantial real dollar price increases."[53] Because of this change, the ECPA amended the EPCA to allow greater increases in crude oil prices. The ECPA directed FEA to use some of the newly allowable price increases to give additional incentives to the use of exotic methods to increase production from existing fields ("tertiary recovery") and to remove some regional crude oil price differences.[53a]

II: REGULATIONS UNDER THE EMERGENCY PETROLEUM ALLOCATION ACT

As mentioned in the previous section, a new and comprehensive program of oil price controls was established in August 1973. Although altered and expanded by Congressional and administrative action, that program remained the same in broad outline from August 1973 until December 1975. The most significant change occurred when the crude oil entitlements program was established in December 1974.

Effects of the regulatory program developed in Phase IV and under the EPAA, while still somewhat uncertain, are much better documented than are the effects of the new price controls established in January 1976. Moreover the concepts and organization of present controls are very close to those applied in August 1973 through December 1975. Consequently a description and evaluation of the Phase IV regulatory system can contribute to prediction of the effects of current regulations.

The new oil pricing regulations issued on August 19, 1973 established a comprehensive set of controls at every level of the petroleum industry -- crude oil production, refining, distribution, and retailing. The controls were applied product-by-product, and were intended to provide a clear incentive to increase oil production.

Regulations affecting crude oil and petroleum products under Phase IV and the EPAA included four major programs:

- Crude oil price controls
- Crude oil cost equalization program (entitlements)
- Petroleum product price controls

Mandatory petroleum product allocation program

Today, crude oil price control and cost equalization programs are the key elements in FEA regulation. Together they shape the basic condition of energy markets. The effects of crude oil programs on energy markets can be assessed in qualitative and, in some cases and subject to some uncertainty, quantitative terms.

Refined product price control and allocation programs are highly visible in daily operations at all levels of the petroleum industry and could in principle have pervasive effects on economic efficiency. However, as this study is being written no conclusive evidence about the magnitude of those effects is available. Consequently evaluation of the refined product programs must be confined to qualitative judgments.

CRUDE OIL PRICE CONTROLS

By January 1974, the regulations developed in Phase IV of the Economic Stabilization Program subjected about 60 percent of crude oil produced in the United States to price controls. Imported oil was not subject to any price controls.

The objective of the crude oil program was to hold down the average cost of crude oil produced in the U.S. with the least possible reduction in incentives to increase production. The hiatus in mandatory price controls during the early months of 1973 petroleum allowed prices to rise to levels adequate to cover current costs and restored market determined price differentials between types and grades of crude. The unexpected rise in world oil prices that occurred during

1973 would in time have cuased domestic oil prices to rise to parity with the price of imported oil. Such an increase would have given owners of wells in production during 1972 profits far higher than were anticipated when the investment decisions that created those wells were made. Those profits would have been true "windfalls." Consequently the CLC initially imposed controls on oil produced from properties that were in existence during 1972.

In August 1973 the CLC set the price of controlled oil at its May 15, 1973 price plus $1.35. In addition, CLC issued regulations that allowed oil producers to sell some of their production at uncontrolled prices.

The reason that ceiling prices were keyed to actual prices in 1973 is that crude oil is not an homogeneous commodity. Physically, crude oil from one reservoir can differ greatly from crude oil from another: one type of oil may be thicker and more viscous than another, may have a different sulfur content, or contain a different mixture of hydrocarbon compounds. These differences in quality have been reflected in price differentials for different types of crude. Even physically similar crudes may differ in price depending on location. The well-head price of crude which must be transported further to reach a refinery will be less than the well-head price of a similar crude transported a shorter distance to the refinery.

To maintain these crude price differentials without a massive administrative burden of setting individual regulations, the CLC set price ceilings by ordering a uniform adjustment to the price at which crude was sold on an earlier date, when price

differentials were set by market forces. In the case of controlled oil, the regulation stated that "[t]he lower tier ceiling price for a particular grade of domestic crude oil in a particular field is the sum of (1) the highest posted price at 6 a.m., local time, May 15, 1973, for transactions in that grade of crude oil in that field ..., and (2) $1.35 per barrel.[54]

The classification of oil as "controlled" or "uncontrolled" hinges on the definition of a "property," since price controls are implemented on a property by property basis. During 1974 and 1975 a property was defined broadly, as "the right to take oil from a specified reservoir." In general a property coincided with the right granted by an oil lease on a tract of land.[55]

A more precise definition of oil not subject to price controls includes three categories:

- "stripper well lease oil," oil from properties that produced less than 10 barrels per well per day during the previous calendar year, was exempted from FEA'a authority by an amendment to the Trans-Alaska Pipeline Act (October 19, 1973).
- "new oil" was defined as that amount of crude oil produced from a given property in a given month in excess of the amount produced from the same property in the same month of 1972. New oil includes all oil produced on any property that was not in production during 1972. "released oil" was defined as an amount of oil equal to the amount of new oil produced from a property.

For example, if the 1972 production level was 50 barrels per day, and the owner produced 60 barrels per day in 1973, 20 barrels (10 new plus 10 released) would be exempt from controls, and 40 barrels would be subject to controls. That 40 barrels is also called "old oil." The proportion of domestic oil production assigned to each category during 1974 and 1975 is given in Table 2.

These rules apply only to properties on which no "cumulative deficiency" exists. Any producer whose production falls below its 1972 level in any month must make up that deficiency from new oil production before any new oil may be sold at uncontrolled prices. For example, suppose a property produced 100 barrels per day during every month of 1972 and 1973, but that in January and February of 1974 production fell to 50 barrels per day. Then in March and later months, production in excess of 100 barrels per day would not immediately qualify as new oil, but would be applied to reducing the cumulative deficiency created in January and February. Only after 100 barrels of additional output were produced would the increment be classified as new oil.

While these regulations were in effect the price of uncontrolled oil rose from $9.82 per barrel to $12.99 per barrel, but the price of controlled oil remained at an average of $5.03 per barrel.[56]

The two-tier system of price controls can be seen as a device for capturing a portion of the economic rent inherent in oil fields developed prior to the rise in world oil prices. Controlled oil, when Phase IV regulations went into effect in 1973, was oil already being produced from fields that were developed when the selling price of crude oil was below $4.00 per barrel. Prices well above that level

Table 2

Crude Oil

Percentage of Domestic Production Sold at Controlled and Uncontrolled Prices

		Controlled	Uncontrolled		
		Old Oil	New Oil	Released	Stripper
1974	January	60	17	10	13
	February	62	15	10	13
	March	60	16	11	13
	April	60	16	11	13
	May	62	15	10	13
	June	63	15	9	13
	July	64	15	9	12
	August	66	14	8	12
	September	67	13	8	12
	October	66	14	8	12
	November	67	13	8	12
	December	66	14	8	12
1975	January*	58	19	10	12
	February*	61	17	9	12
	March	60	18	10	12
	April	61	17	9	12
	May	62	17	8	13
	June	63	16	8	13
	July	62	16	8	14
	August	63	16	7	14
	September*	63	15	7	14
	October	63	16	7	14
	November	64	15	7	14
	December	63	16	7	14
	AVERAGE	62	16	8	13
1976	January	54	21	10	15
	February	58	28	–	14

*Totals do not add to 100 due to rounding.
Source: FEA Crude Petroleum Production Monthly Report.

Source: FEA Monthly Energy Review, August, 1975 and July, 1976.

translated in 1973 into pure economic rent accruing to the owners and producers of old oil. Price controls used some of that "rent" to reduce consumer prices.

CRUDE OIL ENTITLEMENTS

The crude oil cost equalization (or "entitlements") program is intended to ensure that, with specific exemptions mentioned below, all refiners incur the same average crude oil cost. In addition, the entitlements program makes the cost of incremental crude oil purchased by any refiner equal to the national average cost of crude oil inputs to refineries.

The Operation of the Entitlements Program

An entitlement is the right to process a barrel of price controlled crude oil. Every refiner must have an entitlement for each barrel of price controlled oil it runs.

Entitlements are given to each refiner monthly: each receives a number of entitlements equal to the number of barrels of price controlled oil it would run if the percentage of controlled oil in its total crude oil input were the same as the national average. If the percentage of controlled oil exceeds the national average, the refiner must purchase additional entitlements from some other refiner which was given more entitlements than needed for the amount of controlled oil in its refinery runs. For example, in December 1974 the national average percentage of controlled oil in refinery inputs was 40%. A refiner which ran 1 million barrels of oil in that month would

receive 400,000 entitlements. If it were in fact using only 200,000 barrels of controlled oil, it would have 200,000 entitlements to sell, whereas if it were using 800,000 barrels of controlled oil, it would have to buy 400,000 entitlements.

The number of entitlements that refiners are required to sell in every month will always equal the number that must be purchased. Ideally, the price of an entitlement would be set so that the cost advantage that would be created by greater access to controlled crude is exactly removed. Such a price would equal the difference between the cost of controlled oil and the cost of uncontrolled oil. In September 1975 the average cost of controlled oil was $5.00 and the average cost of imported and uncontrolled oil was $12.50. If an entitlement was worth $7.50, any refiner who substituted a barrel of imported oil for a barrel of controlled domestic oil (raising crude costs by $7.50) would have available an unused entitlement that could be sold to recoup that $7.50.

Somewhat more complex analysis is required to establish that entitlements make the marginal cost of crude oil to any refinery equal to its average cost. Consider the case of a refiner deciding to increase refinery runs by one barrel. Suppose that the refiner must choose between a barrel of controlled oil at $5.00 per barrel and a barrel of imported oil at $12.50 per barrel. If the controlled oil is purchased, the refiner will need an additional entitlement, but will automatically receive four-tenths of an entitlement (because total crude oil input increases by one barrel). If an entitlement is worth $7.50, purchasing the controlled oil will actually cost $9.50 per barrel (= $12.50 - .4 × $9.50), because the refiner gains the $3 value of the

additional four-tenths of an entitlement.

Similarly, if one additional barrel of imported oil is purchased, the refiner will need one less entitlement and will receive an additional four-tenths of an entitlement worth $3. The net cost of a barrel of imported oil is thus reduced to $9.50 per barrel. Consequently, no matter whether the refiner buys a barrel of oil at the average uncontrolled (import) price or at the average controlled price, its cost after entitlements will be the same. That cost will in turn equal the national average cost of all crude oil inputs -- in this case .4 × $5.00 + .6 × $12.50 = $9.50.

The Need for Entitlements

A two (or more) tier price system for crude oil can hold down the average cost of crude (at the expense of crude oil producer's profits), and keep that average cost below what it would be with a single market-determined price. Section I of this report mentioned that under current production and demand conditions, absent controls all domestic crude oil would sell at a price (adjusted for quality and location) equal to the landed cost of imported oil. Multi-tier price controls prevent all oil from selling at that price.

Such a system of crude oil price controls would not by itself lower the prices paid for refined products. Even with price controls the lowest cost source of incremental crude oil for refiners was imports. Increased production of old oil would occur only if refiners bid up its price, which they could not because of price controls, and increased production of new oil -- which already sold at world market prices -- would occur only if prices above the cost of imports were paid.

Consequently when refiners as a whole increase or decrease (within limits) their production rates, they do so by changing their purchases of imports. In the absence of entitlements, the effect of crude oil price controls would be to hold down the price refiners pay for some of their crude oil inputs, but to leave the cost of incremental oil inputs unchanged. If there were no petroleum product price controls but only crude oil price controls, the prices of petroleum products would be bid up until they equalled the marginal cost of crude oil -- i.e., the cost of imports -- plus a markup for operating costs and profit. As long as demand is sufficiently large that refiners must purchase some imported oil to meet it, refiners will only produce suffficient products if the market price of petroleum products is based on the cost of imports. In the absence of entitlements, price controls would serve only to increase refiners profits, reducing the cost of some refinery inputs and thus by transferring revenues from the producing sector to the refining sector.[57]

The entitlements program utilizes competitive market forces to pass those profits directly through from crude oil producers to refined petroleum product consumers. Ideally, entitlements would make the cost of any barrel of oil purchased by any refiner equal to the average cost of crude oil to all refiners. Thus all refiners would sell petroleum products at prices based on the average cost per barrel of total crude oil input, which is less than the cost of imported oil.

The entitlements program was invented in FEA to deal with a problem created by the existence of price controls and cost pass-through rules in each sector of the petroleum industry. The two-tier

price system resulted in different refiners having different costs for crude oil. A refiner purchasing (or owning) more controlled oil -- measured as a percentage of total crude input -- than another would have lower costs. Given product price controls at each level after the refining level, the lower crude cost would be reflected in lower product prices than could be charged for products produced from higher cost crude. This was perceived in FEA as creating a competitive disadvantage for refiners using higher priced crude, and it was decided that a crude oil cost equalization program was required if such refiners were to survive.[58]

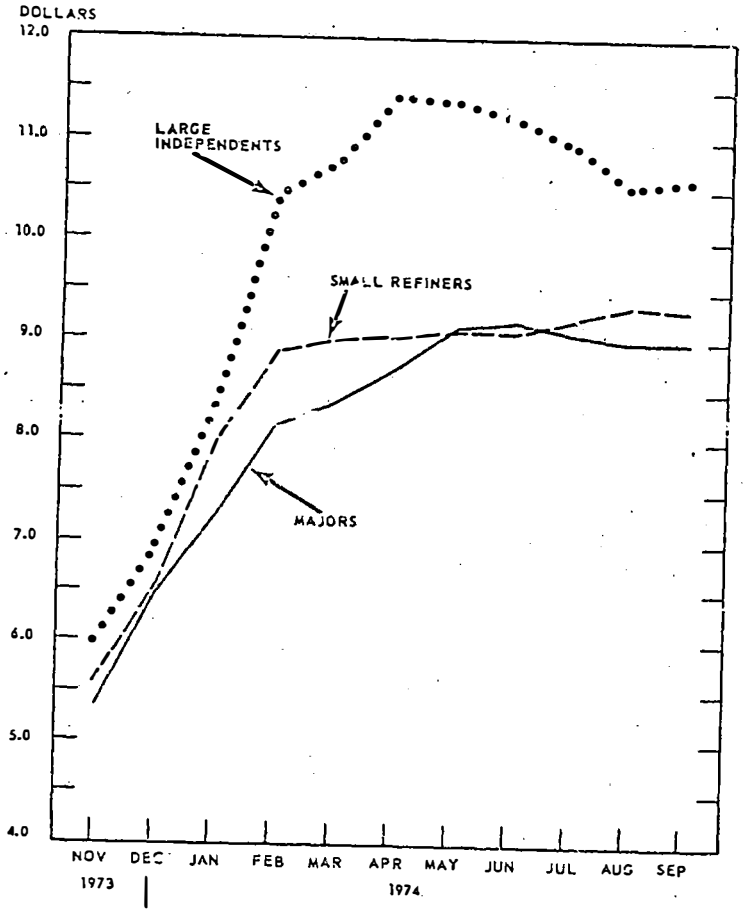
The two-tier price system was in effect for over a year before the entitlements program was instituted. Figure 5 displays the different crude oil costs that faced different types of refiner during that time.

Other problems were also created by the two-tier system with only one tier subject to controls. Stories abounded of tie-in sales: a crude owner offering controlled crude for sale only if the purchaser would also purchase some new oil at a price far above the normal market price. (Subsequent FEA investigations found no evidence of such dealings).[59] Another fear was that the higher price of imported oil might reduce oil imports during a time when domestic supplies were clearly inadequate to meet demand at the controlled prices.

Table 3 shows that during 1975 the average across all refiners of the cost of crude oil was the same before and after the value of entitlements is taken into account. Not all types of refiner, however, faced the same costs, and within types refiners varied dramatically

Figure 5

AVERAGE COST OF CRUDE OIL
PURCHASED BY MAJOR OIL COMPANIES, SMALL REFINERS,
AND LARGE INDEPENDENT REFINERS
FOR THE PERIOD NOVEMBER 1973 THROUGH SEPTEMBER 1974



Source: "Problems of Independent Refiners and Gasoline Dealers"
U.S. General Accounting Office, April 4, 1975, p. 8.

TABLE 3

FRE AND POST ENTITLEMENT CRUDE COSTS BY CLASS OF REFINERS

(in ¢ per Bbl.)

Revised: July 16, 1976
Source: Entitlements Program

	LARGE INTEGRATED REFINERS		LARGE INDEPENDENT REFINERS		SMALL REFINERS		SMALL & INDEPENDENT REFINERS		ALL REFINERS	
1975	FRE	POST	FRE	POST	FRE	POST	FRE	POST	FRE	POST
JANUARY	9.65	9.76	10.29	10.00	9.20	9.06	9.56	9.38	9.63	9.65
FEBRUARY	9.96	10.18	10.59	10.12	9.54	9.23	9.93	9.56	9.95	9.89
MARCH	9.72	9.85	10.63	10.20	9.54	9.52	9.94	9.77	9.79	9.83
APRIL	9.70	9.86	10.81	9.81	9.50	9.42	9.92	9.55	9.77	9.77
MAY	9.74	9.93	10.67	9.76	9.57	9.34	9.92	9.47	9.80	9.80
JUNE	10.04	10.21	11.53	10.74	9.92	9.79	10.43	10.12	10.17	10.19
JULY	10.37	10.59	11.23	10.61	10.33	10.03	10.68	10.25	10.47	10.45
AUGUST	10.59	10.91	11.52	10.22	10.27	9.83	10.73	9.97	10.63	10.63
SEPTEMBER	10.43	10.71	11.52	10.23	10.42	9.97	10.80	10.06	10.53	10.53
OCTOBER	10.70	11.02	11.76	10.43	10.53	10.12	10.97	10.23	10.78	10.78
NOVEMBER	11.03	11.37	11.94	10.13	10.69	10.34	11.09	10.27	11.05	11.05
DECEMBER	10.60	10.92	11.76	10.53	10.51	9.89	10.95	10.11	10.69	10.69
1976										
JANUARY	10.70	11.03	11.91	10.69	10.69	10.12	11.08	10.30	10.81	10.81
FEBRUARY	10.31	10.63	11.77	11.19	10.31	10.63	10.65	9.96	10.41	10.42
MARCH	10.04	10.32	11.87	10.85	10.49	10.05	10.92	10.30	10.30	10.31
APRIL	10.31	10.57	12.18	11.38	10.63	10.33	11.14	10.68	10.57	10.60
MAY	10.15	10.59	12.16	10.88	10.85	10.25	11.30	10.47	10.51	10.51

in their crude oil costs.

Even in an ideal system, entitlements would not equalize the cost of controlled and uncontrolled oil for all refiners, only for those that faced an actual price differential equal to the average differential. Since price control regulations may specify different prices for crude oil produced from different properties and since imports vary in price by grade, quality, and port of entry, such deviations are likely.

In addition, the entitlements program that existed during 1975 had two sources of bias that systematically provided some refiners with lower crude oil costs than it provided others.

Small Refiner Bias

The entitlements system has from its inception provided favored treatment to small refiners -- the definition of which has varied. When entitlements were first introduced, Special Rule Number 3 allowed small refiners to assume gradually the obligation to purchase entitlements. Any refiner with capacity below 30,000 barrels per day was exempt from the program for two months. During the third month such refiners were required to purchase only one-third of their entitlement obligation, and during the fourth month two-thirds. Only after four months were such refiners required to have a full entitlement for each barrel of controlled oil they ran. Refiners with capacity between 30,000 and 100,000 barrels per day were given similar relief, on a declining scale; refiners with 100,000 barrels per day capacity or more were placed under the entitlements system immediately.[60]

Small refiners have in addition been granted preferential treatment under the entitlements program to preserve the advantages that existed during the sixties under the import control program. All refiners, large and small, receive a basic monthly allocation of entitlements; each refiner with capacity less than 175,000 barrels per day is granted additional entitlements on a sliding scale.[61] No additional entitlements are granted to refiners at the 175,000 barrels per day level; 1,258 are granted to a refiner with 100,000 barrels per day capacity; 1,690 to a refiner with 30,000 barrels per day capacity, and 123.8 per thousand barrels to refiners with capacity under 10,000 barrels per day.

This "small refiner bias" has existed since the inception of the entitlements program. When the price of entitlements reached its peak, $8.94,[62] in November, 1975, the cash equivalent of 1,238 entitlements was $11,000. Refiners with less than 10,000 barrels per day capacity received the largest per-barrel benefit under the program -- .1238 entitlements per barrel, translating into $1.10 per barrel or 2.6¢ per gallon subsidy.

In December 1975 Congress amended the EPAA to exempt certain small refiners from the entitlements purchase obligation entirely. In Special Rule Number 6, issued on December 31, 1975, the FEA retroactively exempted all refiners with capacity less than 50,000 barrels per day from the purchase requirement. Refiners with capacity between 50,000 and 100,000 barrels per day were required to purchase entitlements on a sliding scale: at 75,000 barrels per day, for example, a refiner faced a purchase requirement one-half as large as it would have been absent Special Rule Number 6.[63]

Special Rule Number 6 benefitted only small refiners that were required to purchase entitlements, reducing their crude oil costs below those incurred by refiners of the same size that were required to sell entitlements. FEA found that the maximum advantage given by Special Rule Number 6 amounted to 23 cents per gallon, or $9.66 per barrel. Table 4 shows how those benefits were distributed among exempted refiners.

In December 1975 seven received less than 1 cent per gallon and nine more than 10 cents, while 33 were in between. Sixty-four refiners with less than 100,000 barrels per day capacity received no benefits, because they were entitlement sellers.

The exemption, which was applied retroactively to October, November, and December 1975, resulted in great variations in crude oil costs among refiners (see Table 5). A refiner exempted completely from the entitlement purchase requirement and able to obtain 100 percent of its crude oil from price controlled sources could have incurred a crude oil cost of $5.00 per barrel (or less, since some oil was controlled at prices as low as $3.00 per barrel). A refiner not exempted could have incurred a post-entitlement crude oil cost of $10.92, the average December post-entitlement cost for major refiners, or more if crude oil of above average cost were purchased. Spreads wider than $6.00, as reported in Table 4, are possible because some refiners paid less than average prices, while others paid more. Because these differences between actual prices paid for crude oil by individual refiners and national averages existed prior to Special Rule Number 6, not all of the cost variation in Table 4 can be attributed to the Rule. Moreover, some variation could also result from

Table 4
Distribution of Benefits of Special Rule 6

	October 1975	November 1975	December 1975—
Number of exempted firms [1]	52	51	49
Maximum cent-per-gallon benefit	20	17.5	23
Total value of exemption	$25,020,000	$61,770,000	$25,695,000
Range of benefits to exempted firms	$2,095-$1,372,000	$6,270-$1,198,000	$9,000-$1,556,000
Number of firms with per gallon benefits ranging from:			
Up to 1 cent	13	7	7
1 cent up to 5 cents	21	21	23
5 cents up to 10 cents	15	14	10
10 cents and over	4	9	9

[1] For October, 4 of the firms receiving benefits from the exemption were partially exempted, and for November and December, respectively, 5 and 3 firms were partially exempted.

Source: 41 Federal Register 3992, March 4, 1976.

Table 5

Postentitlement crude costs for December 1976

Region [1]	Highest in dollars per barrel	Lowest in dollars per barrel	Difference between highest and lowest
1	13.14	7.73	5.41
2	12.42	9.40	3.02
3			
4	12.76	6.33	6.43
5	11.35	9.69	1.66
6	11.26	5.60	5.66
7	13.52	6.05	7.47
8	10.77	4.18	6.59
9	10.31	5.60	4.71
10	13.49	6.17	7.32
11	10.39	9.26	1.13
12	11.35	6.82	4.53
13	9.44	3.39	6.05
14			

[1] Bureau of Mines refining districts.

Source: 41 Federal Register 9392, March 4, 1976

exemptions from entitlement purchase requirements granted by FEA's Office of Exceptions and Appeals.

REFINED PRODUCT PRICE CONTROLS

Price controls were placed on refined products in the Phase IV regulations in order to prevent refiners or marketers from raising prices in the face of a shortage of various products. Until the entitlements program was devised, they were also necessary to prevent product prices from reaching their equilibrium level, which would be based on the price of imported oil rather than the average cost of all oil. Refined product price controls allow price ceilings to be raised only if certain types of costs incurred by refiners or marketers increase.

Price Controls on Refiners

Since shortly after the promulgation of Phase IV regulations the base price for each product sold by a refiner has been the price at which it was sold, to a particular class of purchaser, on the same date to which crude oil price controls are keyed. Certain types of cost increases occurring subsequent to that date could be passed through on a dollar for dollar basis.

Under EPAA regulations, the ceiling price was equal to

> (1) The refiner's May 15, 1973 selling price to a class of purchasers for that product plus (2) an amount representing the increase in the cost of crude oil to that refiner since May 15, 1973, plus (3) under certain circumstances, some of the increased costs of doing business (other than increased costs of crude oil) such as increased labor, marketing, or utility costs.[64]

Each refiner could have a different ceiling price for each class of purchaser. If the refiner sold gasoline to independent, unbranded marketers at a low price on May 15, 1973, the low price was perpetuated. The allocation program, described below, required refiners to continue to make sales to each class of purchaser on a uniform basis.

The theory underlying the choice of dates is that under Phase III price adjustments adequate to restore market-determined price differentials and profit margins had occurred; that if crude oil prices and other costs were unchanged, refined product prices would be adequate to maintain refiners' profits; and that having crude oil and product price controls keyed to the same date would simplify the task of tracking price and cost increases.

Adjustments to product price ceilings are designed to recover an amount of revenue equal to the allowed cost increases. The adjustments operate with a lag: if a refiner incurs allowable cost increases of $50,000 in January the refiner is allowed to increase prices during February or any later month sufficiently to generate an additional $50,000 in revenue over and above the revenue that would be earned with projected sales at January prices. Allowable costs that have not yet been recovered through price increases are called "banked" costs. At various times, there have been limitations on what types of cost may be banked and on how these banked costs may be applied to increase product prices.[65]

The manner in which increased costs could be allocated among various types of product was also specified in the regulations. Through

1975 FEA distinguished four classes of products: general refinery products, (including residual fuel oil), special products (home heating oil and diesel fuel), gasoline and propane.[66] Special products could not be assigned more than their proportionate share of product costs. For example, if a refinery produced 50,000 barrels per day of product, of which 5,000 was home heating oil or diesel fuel, only 10% of allowable cost increases could be applied to raise ceiling prices on those fuels. General refinery products must also, taken together, bear no more than their proportionate share (by volume) of increased costs, but refiners may allocate costs as they wish within that category. Gasoline, on the other hand, may be allocated as much of the refiner's increased costs as the refiner wishes.

Refiners were required to maintain a single price for a product to all customers within a particular class, based on a weighted average of the prices the refiner charged members of that class on May 15, 1973. Again, the purpose of this regulation was to preserve the market structure and distribution patterns that existed prior to the imposition of controls. However, the "single price" rule prevented refiners from granting individual or regional price concessions in order to assist their branded retailers during local price wars or for other reasons.

Price regulations encouraged refiners to maintain historical differentials between the weighted average prices charged different classes of purchasers while allowing some flexibility in allocation of increased costs. If a refiner allocated some portion of increased costs equally among classes of purchasers, the remainder could be

banked and used to increase prices at some later date. If, on the other hand, a refiner increased prices to one group by, say 2 cents per gallon and increased prices to all other groups by 1 cent per gallon, the amount of costs that could be banked would be computed as if the largest price increase had been imposed on all purchasers. That is, to continue the example, suppose a refiner had allocated $50,000 of increased cost to one product, and that there were only two groups of purchasers, the first of which had its price increased by 2 cents and the second by 1 cent, providing the refiner with $30,000 of additional revenue. That refiner could not bank $20,000. Rather, the refiner would have to subtract from $20,000 the revenue that would have been earned if the price increase to the second group had been 2¢ rather than 1¢. If charging both groups 2 cents would have increased revenue by $40,000, the refiner could bank only $10,000. Consequently, there was an incentive to equalize price increases.

This provision allowed for some flexibility in pricing, in that to raise prices to one group of customers a refiner need not raise prices to all groups, but it did impose a penalty on unequal treatment.

If a refiner could bank the costs not recovered because of the decision to hold prices to some group below the ceiling, those costs might be used subsequently to increase the ceiling price to a different group. To prevent this circumvention of the equal treatment rule, such unrecouped costs may not be banked.

Wholesaler - Retailer Price Controls

Price controls at the third, and final, level of the industry are simpler and more uniform than at other levels. Wholesaler and retailers may pass through to customers their increased product costs, and must apply their increased costs of any product only to that product. They may bank any unrecovered costs.

Because the large number of independent ventures at this level of the industry makes auditing prohibitively expensive, increased non-product costs may not be passed through on an individual basis. Instead, FEA periodically orders adjustments in product price ceilings to reflect average increases in non-product costs.

During conditions like those of the 1973 embargo, when price controls on oil producers and refiners combined with reduced imports to produce a true shortage of refined products, price controls on the wholesale and retail sector were required to prevent marketers from capturing most of the benefits of price controls on earlier stages of the production chain.

CRUDE OIL ALLOCATION

The mandatory allocation program for crude oil, instituted in December 1973, included a freeze on purchaser-supplier relations and a "buy/sell" program, which was intended to provide all refiners with equitable access to crude oil.

The purchaser-supplier freeze was the device chosen by FEA to achieve two objectives of the Emergency Petroleum Allocation Act, the maintenance of existing channels of petroleum distribution and

protection of the independent sector of the industry.

The purchaser-supplier rule for crude oil provided "that all supplier/purchaser relationships in effect under contracts for sales, purchases, and exchanges of domestic crude oil on December 1, 1973, shall remain in effect for the duration of the mandatory allocation program."[66] For refined products, the purchaser-supplier rule freezes relationships to what they were in 1972.

FEA has given three justifications for the purchaser-supplier freeze.

1) The freeze made it possible for small and independent refiners to estimate the deliveries they would receive during February, March, and April, 1974. Those estimates were the basis of the buy-sell list, discussed below.

2) "Since most domestic crude oil contracts were year-long contracts which would not terminate until after December 31, 1973, maintaining supplier/purchaser relationships as of December 1, 1973 preserved and stabilized most of the nations' crude oil distribution at the time when the potential for disorder was at its peak."[67]

3) The freeze made it difficult to circumvent crude oil price controls. Knowing that his supplier was obligated to continue supplying crude oil in the same quantities as in the past, the present purchaser would have no incentive, and could not be pressured, to arrange back-door methods of increasing the suppliers' revenues from sales of controlled crude.

The crude oil "buy/sell" program at first applied uniformly to all refiners, regardless of size. At one point, a major oil company was required to sell large amounts of crude oil to another major.

The "buy/sell" program was later revised to entitle only small and independent refiners to buy crude oil in specified amounts from the 15 largest integrated refiners.

Small and independent refiners are defined, respectively, as refiners with a total capacity not in excess of 175,000 barrels per day and as refiners that control crude oil production equal to less than 30% of their capacity. Each such refiner is allowed to purchase from assigned sellers an amount of crude oil that would make up the difference between the refiners' 1972 production level and the level to which the refiner was restricted during February to April, 1974 (the oil embargo). That purchase requirement is added up across all eligible buyers, and assigned to refiner-sellers. The price at which these transactions will take place is also specified by the FEA. Until recently, the transaction price was to equal the weighted average price paid for all crude oil by the refiner-seller, with a handling fee and transportation costs added. Although apparently equitable, this pricing rule could lead to a situation in which a refiner-seller was forced to purchase imported oil which he then resold at a lower price. In July, 1976, the transaction price was changed, to equal the average cost of imported oil to the refiner-seller.

The loss which the major refiners took on reselling foreign crude was added by them to their foreign crude oil costs, and thus could be passed on to their customers. The effect of the program, however, was to give small and independent refiners a certain cost advantage.[68]

REFINED PRODUCT ALLOCATION

The refined product allocation program is also based on a purchaser-supplier freeze. Every supplier of refined products is obligated to continue offering those products to the same purchasers which were supplied in 1972. If the supplier does not have sufficient quantities to provide every purchaser with the quantities it is entitled to purchase, the supplier must observe several FEA rules regarding the allocation of supplies. Purposes of the allocation program were specified in the EPAA; the purchaser-supplier freeze was instituted both to preserve an existing structure of distribution and to simplify the task of providing products to various priorities of uses.

Priorities in Obtaining Supplies

Allocation works through the fixed purchaser-supplier relation at each stage of the distribution chain. To simplify exposition, it will be assumed that chain includes a refiner, one wholesaler, and one retailer or end-user (which purchases from the wholesaler). Allocation priorities are based on the use to which the refined product is put.

The allocation is based on either the "current requirements" or the "base period volume" of a user. Current requirements of an end user are equal to "the supply ... needed ... to meet its present supply requirements for a particular use of that product," but do not include any amounts purchased for resale or for accummulating or inventory larger than customary.[69] In practice, current requirements will commonly equal what the purchaser is willing to purchase at the current

price. When the end-user purchases from more than one supplier FEA rules specify how current requirements shall be divided among them. The "base period volume" is equal to the amount purchased from the supplier by an end-user during a specified prior month.

An end-user entitled to an allocation claims the allocated product from a retailer, which then has a legal claim on the product from the wholesaler, which in turn may claim it from the refiner. A wholesale purchaser-consumer entitled to an allocation claims it from the wholesaler, who in turn claims it from the refiner.

Priorities in obtaining supplies of refined products are based on the end use of a product, and derive from the priorities specified in the EPAA. There are three priority classes under FEA regulations. Agricultural production and defense have the first priority -- without exception those users are entitled to 100 percent of their requests.

Before defining the method by which each lower priority user's allocation is determined, it is necessary to define the allocation fraction. Each supplier subtracts from his available supplies the amount which must go to the first priority uses and a "set-aside" allocated by state energy agencies. The supplier then divides the remaining supply by the sum of the current requirements of second priority purchasers and base period volumes of the third priority users. The resulting fraction is the "allocation" fraction.

If the allocation fraction is less than one, second priority users -- including emergency services such as hospitals, fire and police - receive an allocation equal to the allocation fraction

times their current requirements. Third priority users receive an allocation equal to the allocation fraction times their base period volume.

If the allocation fraction is greater than one, the supplier may declare "surplus product" all his supplies above what is used to meet current requirements and base period volumes. Under certain restrictions, suppliers may offer surplus product to whomever they wish. One such restriction relates to gasoline. If a supplier is assigned independent marketers as purchasers, the supplier must first offer them a proportion of the excess supply at least as large as their proportion of the allocated supply, before the gasoline may be sold freely. "This requirement prevents suppliers from favoring their owned and operated resellers in distributing surplus product."[70]

Purchaser-Supplier Freeze

Although the supplier is required to offer each purchaser the allocation to which it is entitled, the purchaser is not required to buy from its assigned supplier. At any time, the purchaser may look elsewhere for its requirements, without penalty and without jeopardizing its relation with the assigned supplier.

The allocation fraction for most products has averaged about 1 recently, which would appear to imply that little surplus product is available.[71] However, as much as 10 percent of product sales in a month have involved surplus product.[72]

One reason for this apparent discrepancy is that a supplier may announce as surplus any amount of a product which he does not

expect his assigned purchasers to take. Such surplus is referred to as "underlifted" surplus.

For example, a purchaser might be entitled to an allocation of 50,000 gallons of gasoline. If the supplier expects the purchaser to take only 40,000, he may announce 10,000 gallons of surplus product even if his allocation fraction is less than one. Because of this flexibility considerable amounts -- indeed all -- of a product could be sold as "underlifted" surplus.

Occasionally a supplier is caught off-guard, by a customer who has taken none of his allocation for several years but suddenly decides to claim his allocation. The possibility probably limits the willingness of suppliers to declare surplus product until rather late in the time period during which assigned purchasers may claim their allocation.

Purchasers requiring stable, long-term supplies may also find surplus product sales somewhat unattractive, because a supplier may only be willing to enter into long-term contracts with his assigned customers. Nevertheless, surplus product sales could create a significant spot market of the type that supported the independent marketers in the past.

The type of product that is declared surplus because of underlifting is, however, likely to be high cost product. Because of the unequal incidence of costs on refiners -- created by small refiner bias in entitlements and by unequal non-product and imported crude oil costs -- the same refined product may have many different prices. Customers of suppliers with access to low-cost products would tend to take more of their allocation than purchasers from suppliers with high

cost products, who would be expected to shop around.

These factors, and the simple scheduling problem of finding surplus product before deciding whether to take an allocation, may inhibit purchasers from moving around. As in musical chairs, all purchasers must move simultaneously if there is to be a niche other than the one already occupied. The process could be started, however, by any supplier with an allocation fraction greater than one. Although the average allocation fraction is less than one, the variation of individual suppliers around the average leaves some with a fraction greater than one.

III: EVALUATION OF 1974-1975 CONTROLS

Phase IV controls were instituted during a world crude oil shortage and developed under the severe pressure of the Arab oil boycott. A shortage of refinery capacity existed simultaneously. Under these conditions the extension of price controls and mandatory allocation to all levels of the industry could be necessary to hold down consumer prices and to provide access to petroleum products on a basis judged equitable by policy makers.

However, by the end of 1975 refining capacity was adequate, and unlimited supplies of crude oil were available from foreign sources (at a high price). Under these conditions prices charged consumers could be controlled effectively through the crude oil price control and entitlements system without refined product controls. Although effective in controlling prices, with attendent consumer and macroeconomic benefits, crude price controls and entitlements were responsible for a decrease in the efficiency of use of energy resources.

The remaining structure of product price regulation and allocation can be justified in efficiency terms only if there is a significant lack of competition in the refining, wholesaling, and retailing sector. To be sure, that structure could serve other purposes: to squeeze the profits of specific sectors of the industry, to preserve existing market structure as an independent goal, or to provide price advantages or penalties to specific classes of energy users. For example, during Phase IV and the embargo consumption of

gasoline was seen as less meritorious than heating of homes. Consequently higher retail prices and lower refinery yields of gasoline were encouraged to provide adequate supplies of heating oil at low cost.[73] However, if competition in the industry is adequate, any aggregate consumer benefit from across the board lowering of domestic oil prices could be achieved with the crude oil program alone. Retaining that program alone would also remove many of the individually minor but pervasive -- and in total probably large -- inefficiencies created by product price and allocation rules.

The plan of this Chapter is to identify and evaluate the consequences of crude oil and refined product price control and allocation programs that existed prior to 1976. To carry out that plan it is necessary to provide a description of the basic economies of crude oil exploration, production, and refining.

CRUDE OIL PRICE CONTROLS

Factors Affecting Crude Oil Production

Exploration for oil is characterized by uncertainty and frequent failures. After a series of geological investigations designed to identify the strong probability that oil will be found in a given location, test wells are drilled. Between 1973 and 1975 only 25 percent of all exploratory wells drilled were successful.[74]

Drilling statistics include wells drilled in the hope of extending the boundaries of or increasing production from fields which are already in production. These wells are more often succesful than are exploratory wells, so that on average about two-thirds

of all wells are successful.[75] All exploration and drilling activity, including that in proved fields, carries a risk of failure: the incentive to engage in those activities is provided by the expectation that revenues from productive wells will sufficiently exceed cost of production to compensate for expenditures on attempts that failed to find oil.

For example, suppose that half the wells a company drills are successful, that the company spends $10 million on exploration and drilling, and that the company requires at least a 10 percent rate of return after taxes. Then to earn a 10 percent return on that investment, it must have profits after taxes of $1 million a year. Suppose further that this company drilled 100 wells, at a cost of $100,000 each; and that the 50 successful wells produce oil sold for $100,000, with annual operating costs of $80,000. The profits per successful well are then $20,000 per year ($100,000 - $80,000) for total profits of $1 million.

The total investment in finding and drilling those fifty wells was $5 million ($100,000 × 50); consequently profits on that investment would be about $1 million ÷ $5 million = 20 percent. But these profits are necessary to provide an adequate return on the total exploratory investment, which turned up fifty dry holes as well as fifty productive wells.[76] The return on the total investment involved is just 10 percent.

The decision regarding exploration, then, is based on expectations of profits to be earned from successful wells. Once a well is drilled, however, all exploratory and development costs

are sunk and no longer relevant to decisions about how the well should be used. A well will be kept in operation as long as revenues are adequate to cover its variable costs of operation. In the above example, wells would continue in operation as long as total revenue remained above $80,000 per well, which is $20,000 less than the sum required prospectively to justify investment in finding the wells.

However, opportunities for investing in an oil well or reservoir are not exhausted when the well is first put in operation. Oil is a non-renewable resource, in that every barrel of oil produced leaves one less barrel underground. In many types of field, reduction in the amount of oil left in the ground reduces the pressure which forces oil up the well. Consequently, for any amount of effort supplied by the manager, less oil will be forthcoming over time.

The natural decline in oil production can be overcome by actions open to the oil field manager. For example, it is possible to drill another well and pump water into the reservoir to drive oil out ("reinjection"). Many of these actions involve significant initial investments, which are repaid when oil revenues are increased sufficiently by additional output. Investments which change the characteristics of the oil reservoir to increase production are often referred to as "enhanced recovery."

Some change in production rates can be achieved without going to enhanced recovery. These quickly achievable changes are limited in magnitude, but can be undertaken rapidly in response to temporary price condition. Enhanced recovery projects, because of their long life, are like exploration projects more responsive to expected future

prices. Consequently the effect that price controls have on expectations of future prices is likely to be as important as their effect on current prices.

A Model of Oil Production

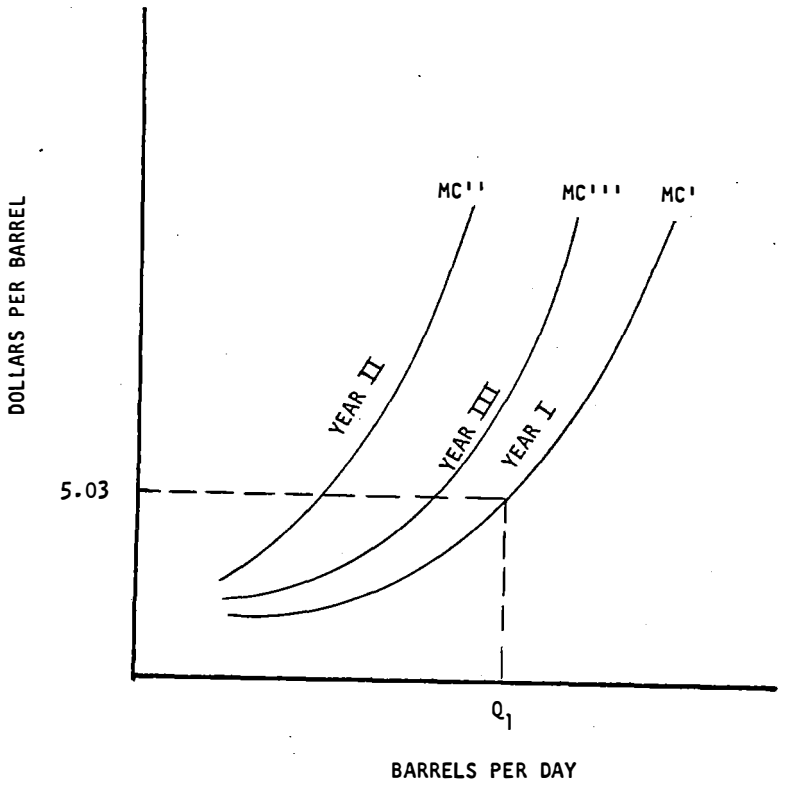
No simple account of how crude oil production decisions respond to regulatory policy can deal adequately with all the complex forces at work. However, some elementary economic concepts can serve to give an orderly and broadly accurate description of the effects of oil price regulations. Three sources of complexity must be kept in mind.

- oil fields differ drastically from one another
- the behavior of a field changes over time, as a function of the amount of oil taken from the field and the method of production
- large, discrete investments are required to make significant changes in a field's production levels.

The decision problem facing a manager is similarly complex. The manager must take into account not only current prices and costs, but also expectations of future prices and the effect which current decisions will have on the future relation between production costs and crude oil output.

To describe these decisions, we posit the existence of a marginal cost curve like that drawin in Figure 6. The horizontal axis measures the production to be achieved from a well in the current year. The vertical axis measures dollars per barrel. The

Figure 6
Marginal Cost Curves in Crude Oil Production



marginal cost curve shows how much it would cost to increase output by 1 barrel per year when output is at the level measured on the horizontal axis.

The position of the marginal cost curve changes over time, as the oil reservoir is depleted. The cost of maintaining any level of output increases over time, and when prices are constant the most profitable output level declines. In terms of Figure 6, this effect is represented by the shifting of the marginal cost curve to the left (from MC′ to MC") over time.

Enhanced recovery can be represented by shifting the marginal cost curve to the right. The curve MC" might be obtained if reinjection were applied to a well that previously had marginal cost curve MC".

Marginal cost curves can be used to predict how much oil will be produced from a well at any given price. Consider, for example, a $5.03 per barrel price. The marginal cost curve reveals that when output equals Q_1, changing output by one barrel will change costs by exactly $5.03. If production were increased much above Q_1, each additional barrel of oil would cost more than the price of $5.03 at which it could be sold. Consequently when prices are $5.03 per barrel, Q_1 will be produced. The marginal cost curve is the supply curve, showing the prices that would induce various rates of production.

Technically, the marginal cost curves discussed thus far are short run marginal cost curves, since they state the relation between cost of increasing production and level of production on the assumption that a specific type of investment has taken place

(None for MC", reinjection for MC"'). It is also possible to construct a long run marginal cost curve that will represent the relation between an existing output level and the cost per barrel of increasing output when the cost of investing in enhanced recovery is taken into account. The long run marginal cost curve is also the long run supply curve and can be used to predict how in the long run oil production will respond to price levels that are expected to be stable over time. At some points in the discussion that follows short term behavior is important, and at other points long term behavior. The distinction will be noted when it matters.

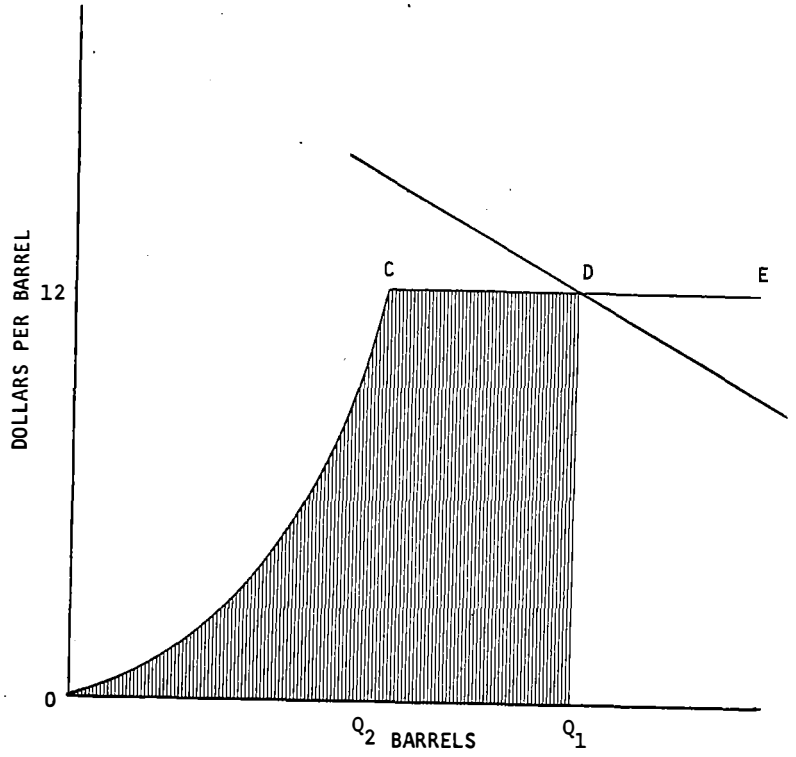
Criteria for Evaluating Crude Oil Price Controls

To characterize an efficient allocation of resources in oil production and consumption it is necessary to examine the market for crude oil. Supply and demand for crude oil is depicted in Figure 7, based on July 1975 prices and quantities.

Demand for crude oil, by refiners, is a derived demand based on consumer demand for petroleum products. If there were no effective price controls on refiners, consumer prices (and demand) would vary with the cost of crude oil to refiners. With adequate competition in the refining industry, the price a refiner is willing to pay for crude oil is a measure of the amount consumers are willing to pay for petroleum products.

Supply of crude oil would, if there were no price controls on domestic crude oil, be represented by the curve OCDE. Up to $12 per barrel OC represents domestic supply; at $12 per barrel unlimited

Figure 7
Supply and Demand for Crude Oil



supplies of imports are available. Since demand at $12 per barrel ($Q_1$) exceeds domestic supply at that price (Q_2), the quantity Q_1-Q_2 of oil would be imported.

Efficiency in Crude Oil Production

With a given level of energy demand, efficient production of crude oil implies keeping the total cost of oil[77] -- the total resources used to produce oil domestically and to pay for imported oil -- as low as possible. In order to achieve the most efficient allocation of resources in oil production, domestic oil production should include all oil that can be produced at a unit cost less than the price of imported oil. This efficient use of resources requires that production rates for all domestic oil fields be adjusted so that marginal cost -- the cost of increasing output by one unit -- is equal everywhere.[78] Marginal cost of domestic production should also equal the price of imported oil. If marginal cost of domestic production is greater than the cost of imported oil, it would be possible to save resources by decreasing domestic output and increasing imports. Alternatively, if marginal cost of any domestic energy production is less than the cost of imports, it would be possible to save resources by increasing domestic production and reducing imports.

These criteria apply to both short term and long term decisions. To avoid complicated technical discussions, it will be assumed that all oil producers include "user cost", or the value of oil resources conserved for later sale, in their perceptions of current cost of production. Whether oil producer's perceptions of the cost of

leaving oil in the ground lead to efficient production decisions will, in part, depend on how price regulations affect those perceptions.

The effects of price controls on economic efficiency in crude oil production can be analyzed by finding how they alter the position and shape of the domestic supply curve OC. As drawn in Figure 7, the supply curve OC represents a situation in which all oil produced domestically costs no more than the market price of oil; market prices are established by the price of imports, because demand exceeds the amount of oil that can be produced domestically at a cost less than or equal to the price of imports.

The area underneath the domestic and import supply curve shaded diagonally in Figure 7 equals the total cost of crude oil. If the conditions of economic efficiency are satisfied, that area will be a minimum. Price regulations that increase the total cost of crude oil impose an efficiency loss equal to the change in cost.

Economic Efficiency in Crude Oil Demand

An efficient level of demand for crude oil would be one in which oil is used only in ways that have an economic value no less, per unit of oil consumed, than the price of imported oil. This result could be achieved if each consumer paid a price for refined products that was based on the cost of imported oil. As long as demand exceeds domestic supply, every change in demand changes the level of imports in a like amount, increasing or decreasing the energy bill by the cost of imports. Unless consumers pay the full price of oil that they cause to be imported, consumption decisions will not be based on the real

trade-offs involved in energy use. Consequently, a system which charges consumers less than the cost of imports can create a loss in efficiency.

Other Criteria

The legislative history of oil price controls makes it clear that an additional criterion for evaluating crude oil programs has to do with the distribution of wealth. Congress intended that price controls should prevent the transfer of income from oil consumers to oil producers and owners of oil properties. The magnitude of that transfer can be estimated by subtracting the revenues that crude oil producers actually receive from selling domestic crude oil under price controls from the amount they would have earned on that quantity of crude oil in the absence of price controls.

Transfer of income is a cost to one sector of the economy, but a gain to another. The cost and the gain cancel each other out when viewed from the point of view of economic efficiency. Transfer of income from consumers to oil companies is not necessarily a cost to the economy as a whole.

Another criterion by which oil price controls may be judged is their impact on oil imports. The efficiency criterion specifies a level of imports at which the cost of oil production is a minimum. Because of the potential damage which reduction in supplies or increases in the price of imported oil could cause, a case can be made that imports should be lower than the level at which the cost of increasing production equals the price of imports.

A competitive petroleum industry in which investment and production decisions were not distorted by special tax incentives, price regulations or import controls would sustain an efficient allocation of resources in oil production and use. Preservation or encouragement of competition could be seen as a means of achieving efficient resource allocation or as a goal in itself.

Price Controls and Crude Oil Production

When price contrlls were imposed on "old" oil in August 1973, ceiling prices were set at levels roughly equal to existing market prices. The initial price rule set ceiling prices equal to the May 15, 1973 selling price plus $.35. The $.35 increase was designed to give all oil producers a $.35 increase in prices that some producers had declared between May 15, 1973 and the effective date of regulations.

Because price regulations did not roll back existing prices, the initial ceiling price gave producers an incentive to continue the same oil production rates that had been adopted before the reinstitution of price controls. With a fixed ceiling price, however, the amount of oil it was profitable to produce would decline over time, as depletion of the reservoir increased unit costs. The exemption of oil produced in excess of 1972 production levels from price controls was designed to give an incentive to maintain or increase production.

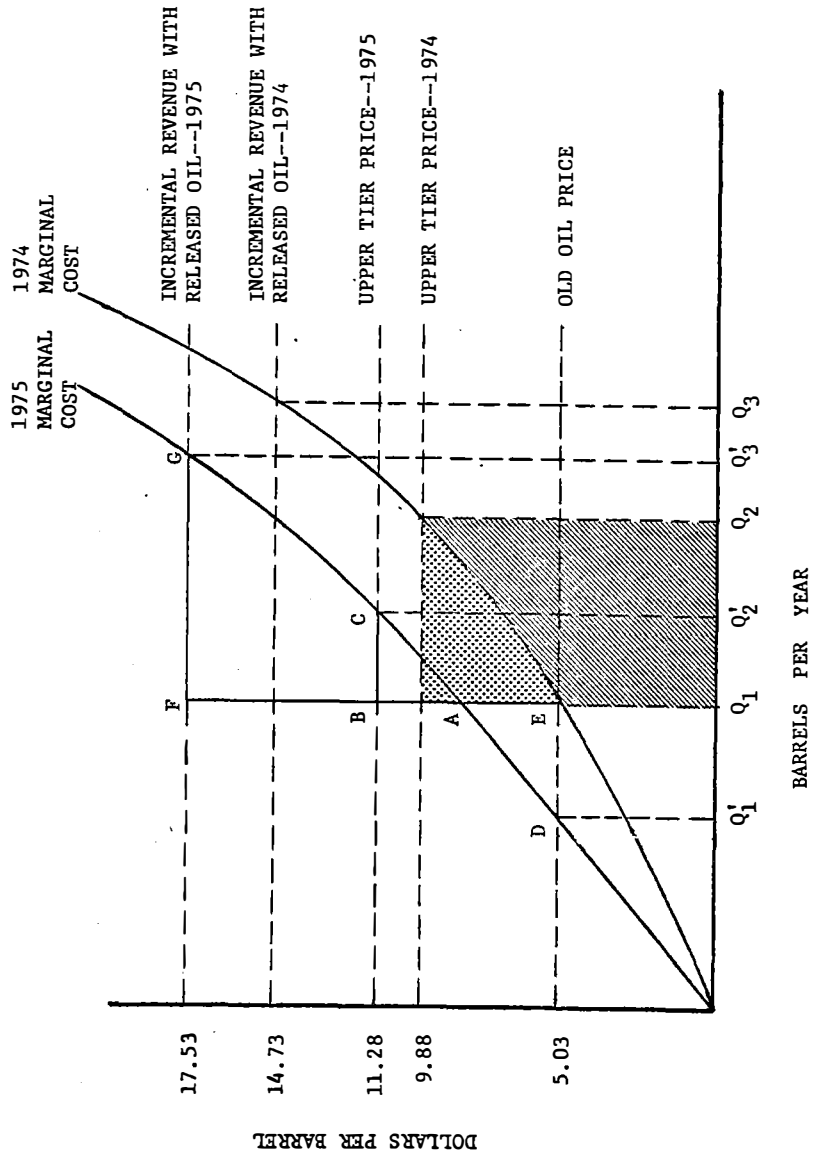
The effectiveness of that incentive depended on how production rates in effect at the beginning of controls related to the 1972 production rates that defined old oil. Because oil prices and production costs had increased between 1972 and 1973, the 1972 production

rate on any property might be larger or smaller than the 1973 rate. If 1973 rates were greater than 1972, any increment to production could be sold at uncontrolled prices (as could the difference between 1973 and 1972 production). If 1973 rates were less than 1972, however, a producer that increased production might be required to sell some of the increment at controlled prices.

In December 1973 the ceiling price for controlled oil was raised by $1.00. The increase was granted to bring controlled oil prices closer to the rising price of imports,[79] but it also served as an additional production incentive. These adjustments resulted in an average price of controlled oil of $5.03 per barrel during 1974 and 1975.

A precise account of the effect of price controls on oil production can be constructed with the aid of the concept of marginal cost. The marginal cost curve labelled "1974" in Figure 8 is constructed with the assumption that Q_1, the amount of oil that would be supplied at a price of $5.03 in 1974, is exactly equal to the amount of oil produced in 1972.

With a two-tier price system that did not include released oil, production in excess of Q_1 would be sold at market prices -- about $10 in early 1974. Suppose that the producer who was producing Q_1 was contemplating an investment that would increase the rate of flow. Then the producer would compare increased revenue, equal to the market price times the increment to production, to the increase in cost resulting from the change in production methods. If the investment appeared sound, it would be made, and the decision would be exactly



the same as it would be if Q_1, the amount of oil subject to price controls, could have been sold for upper tier rather than lower tier prices. Put another way, revenues from existing production are irrelevant to the decision to expand production. Only revenues on the increment resulting from an investment matter.

In terms of Figure 8, the increase in revenues is equal to $9.88 (the average January 1974 price) times Q_2-Q_1, the increase in production. Costs are equal to the diagonally shaded area under the marginal cost curve; consequently by increasing production to Q_2 the producer can earn additional profits equal to the area shaded with vertical lines. When production is at Q_2 the area, and profits, are at a maximum. The rule for maximizing profits is to adjust production so that marginal cost equals marginal revenue -- the rate at which revenue increases when output is increased. In this case marginal revenue equals the market price of $9.88, because every additional barrel of oil can be sold at that price.

"Released" oil complicates the analysis. Every barrel of oil above Q_1 that is produced allows the producer to sell one barrel of his production <u>below</u> Q_1 at market prices. Thus an additional barrel of oil (above Q_1) increases revenues by $9.88 -- the price at which the barrel can be sold -- plus $4.85 ($9.88 - $5.03) -- the increase in the price at which one other barrel of oil can be sold. Consequently marginal revenue is $14.73 -- and output will be increased to Q_3.

Efficient allocation of resources requires that a producer like the one described in this model produce Q_2, the production rate

at which marginal cost equals the price of imports. Released oil results in production of oil that costs more than it would cost to obtain imported oil or oil from new properties.

It is possible that released oil not only results in more than optimum output, but also results in the use of inefficient production methods to obtain that output. This problem derives from the perceived temporary nature of price controls and the "release" provisions. If price controls were removed, marginal revenue could not exceed the free market price of oil, $9.88 in early 1974.

The incentive provided by released oil is purely a creation of price controls. If controls were to lapse -- and their termination date was explicit in the EPAA -- the justification for choosing a production rate with marginal cost greater than market price would disappear. Because the high marginal revenue resulting from released oil could disappear in one or two years, investments taking longer to pay off might appear unwise.

The opposite is true of investments which would be justified if all incremental output could be sold at uncontrolled prices. Removal of controls would not cause those market prices to fall, and would not change the profitability of such investments.

In principle, one would expect producers to respond to the large reward for increasing production by finding ways to achieve temporary increases in production during 1974 and 1975 at the expense of further production levels. Some of these actions would simply bring up earlier oil that ultimately would have been produced anyway; others would mean that in total less oil would be recovered from

the reserve. Some evidence that these actions were being taken can be found in drilling statistics. One method by which short-term increases in production can be achieved is through repairing old wells and drilling new wells in existing fields. Demand for drilling rigs appropriate to these activities climbed during the period of price controls that included released oil, and produced a temporary shortage of such rigs.[80] Another method of increasing output temporarily is by drilling shallower wells — and during the first year of "released" oil the average depth of wells drilling declined. (See Table 6). This method is particularly damaging to ultimately recoverable reserves.

Redrilling of existing fields would be stimulated by the broad definition of a "property", as the "right to take oil from a specific reservoir." All oil produced from a property in quantities less than 1972 production levels (except for released oil) was subject to controls. Consequently if a producer drilled an additional well on a lease in existence in 1972, that well's production could be subject to price controls. If drilling an additional well increased total production from a property, the increment to production generated "released" oil and revenue increased by almost $15 for each barrel of increased production.

The result of released oil provision was to provide a greater incentive to re-drilling of existing fields than to exploration for new reserves. Moreover, the perceived temporary nature of that incentive could divert attention from long-term enhanced recovery projects -- which involve actions to change the properties of the oil

TABLE 6

AVERAGE DEPTH OF WELLS

(Thousands of feet)

1973	Jan	9.00
	Feb	9.46
	Mar	11.57
	Apr	10.51
	May	9.20
	Jun	9.67
	Jul	9.52
	Aug	7.88
	Sept	9.54
	Oct	8.77
	Nov	8.51
	Dec	11.05
1974	Jan	7.57
	Feb	8.97
	Mar	9.40
	Apr	9.67
	May	8.12
	Jun	9.06
	Jul	7.97
	Aug	8.18
	Sept	8.30
	Oct	8.89
	Nov	7.39
	Dec	9.55
1975	Jan	8.17
	Feb	7.49

Source: FEA Monthly Energy Review, July 1976

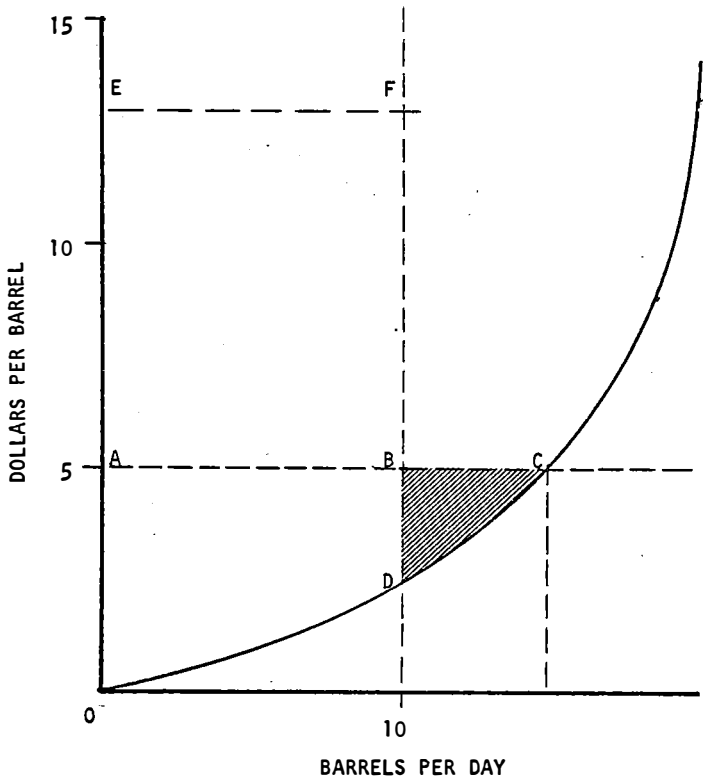
reservoir itself and increase the amount of oil that can ultimately be extracted -- and turn that attention toward short-term ventures.

The exemption of stripper well lease oil from controls actually gave producers an incentive to reduce output. If, for example, a property was producing an average of 20 barrels per day, all of which was being sold at $5.00 per barrel, revenues could have been increased by reducing production to 10 barrels per day. After that rate had been in effect for a year, th entire production from the property could be sold at uncontrolled prices which have been above $10 since September 1974. Not only is revenue from selling 10 barrels at more than $10 per barrel greater than revenue from selling 20 barrels at $5 each, but unit costs of producing 10 barrels per day are lower in many instances than unit costs of producing 20 barrels per day.

The area OAC in Figure 9 represents profits when all oil is sold at controlled prices. If production is reduced to 10 barrels per day profits equal to the area BCD are lost. But the entire 10 barrel per day production can be sold at uncontrolled prices. Profits on that 10 barrels per day are increased from OABD to OEFD. If increased profits on the lower production, AEFB, exceed foregone profits on lost production, BCD, it is profitable to reduce output and qualify as a stripper well.

The perceived temporary nature of price controls could also give producers an incentive to reduce output. Economic models of the relation between price expectations and oil output shows that if prices are expected to rise when controls lapse (as would the

Figure 9
Incentive to Qualify as Stripper Well



prices received by any producer selling its entire output at controlled prices), it is wise to reduce current output so as to save oil for sale later at higher prices.[80a] Technical difficulties in reducing oil production may make the effect of this incentive smaller than a simple model would suggest, but the incentive clearly existed. No quantitative estimates of its importance have been made.

These patterns were likely early in the life of price controls -- into 1974. Because of the rising costs of production as an oil reservoir is depleted, even the incentive that released oil gave to increased production was weakened by late 1975.

The cost of increasing output uses because of removal of oil from a reservoir causes the natural rate of flow to decline. This natural decline in self-driven reservoirs results in production inevitably dropping further and further below any historical production level when prices of oil are constant and no enhanced recovery is undertaken. The older a field becomes, the more its flow rate would have to increase in order to qualify some production for uncontrolled prices.

To increase flow, the first methods of long-term enhanced recovery likely to be usable are pumping and water injection. Both require some fixed investment and increase variable costs. If such techniques do no more than half the natural decline in a field, all oil being produced would still have to be sold at controlled prices.

In analytical terms, the amount of old oil that can be produced at a marginal cost equal to the fixed lower tier price ceiling declines with time. The rate of return on an investment in advanced recovery techniques will depend on how much of the oil

produced with that method can be sold at upper tier prices.

The decline in a field's production potential over time can be represented by the shift of the marginal cost curve in Figure 8 from its 1974 to its 1975 position.

Any oil produced in quantities less than Q_1 must be sold at the ceiling price (here assumed to be \$5.00). However, by 1975 the amount of oil thaat can be profitably produced at \$5.00 declines to Q_1'. If all oil above Q_1' could be sold at \$11.28 -- a representative 1975 price -- Q_2' would be produced. (Again, efficient allocation of resources requires that Q_2' be produced). However, because of the shift in the marginal cost curve, only $Q_2'-Q_1$ can be sold at market prices. A quantity of oil equal to Q_1-Q_1' must be sold at a loss, equal to the triangle ADE. The maximum profit that can be earned selling some output at market prices is the triangle ABC. If the area ABC is less than the area ADE, the producer will let output decline to Q_1'.

The ability to sell new and released oil at market prices may induce production at levels above Q_1 if the amount of oil that costs more than the controlled price at which it must be sold is small. Maximum profits on selling new and released oil would be equal to the area of the triangle AFG, which may exceed the loss taken on selling oil at controlled prices, ADE. If this is the case, Q_3', the profit maximizing output with released oil, will always be larger than Q_2'. If AFG is less than ABC, then ADE is also less than ABC, so that only Q_1' is produced. The general conclusion is that under price controls in existence during 1974 and 1975 oil producers always produced at a lower rate (if they produced no new and released oil) or at a higher rate (if they produced any new and released oil) than required for efficient

allocation of resources in oil production.

The disincentive to increased production that resulted from the natural tendency of production rates to decline was exacerbated by the FEA regulation regarding "cumulative deficiency." Any producer whose production falls below its 1972 level in any month must make up that deficiency before any future increases in production quality as "new" oil.

The cumulative deficiency provision was quite important because the difference in price between new and old oil widened quickly during the period of price controls. When controls began, the price of new oil was so close to the price of old oil that in some cases there would be no incentive or reason to arrest the natural decline in oil production. A decision in 1973 to allow production to decline below 1972 levels resulted in a large cumulative deficit by 1974, when the price of new oil was almost twice the price of old oil. At that time, desirable investments in advanced recovery become unprofitable because of the losses producers would incur in overcoming the cumulative deficiency.

The effect of this regulation is to push Q_1, the production level that must be achieved before incremental output may be sold at market prices, to the right at the same time that nature is pushing the marginal cost curve to the left. The combination of effects was sufficient to make increased production highly unattractive by late 1975.

Table 2 showed that production of released oil declined during 1974 and 1975, despite the rising price of imports and the

and the widening differential between controlled and uncontrolled prices. These developments increased the reward for producing a barrel of new oil (and releasing a barrel of oil from controls) from $14 in early 1974 to $22 in late 1975. Nevertheless, production of released oil declined in relative and absolute terms. Production of stripper well lease oil, on the other hand, increased in absolute and relative terms.

Some Specific Examples

Four situations can be compared to illustrate the effects of FEA price controls in 1975 on the incentive to increase production from existing properties. In each situation certain technical and market conditions will be assumed. The current production rate on the property is 150 barrels per day, and the operator is considering an enhanced recovery investment that would raise production to 300 barrels per day. The investment would cost $2.5 million, but would require no increased operating costs. Finally, it is assumed that when the investment is under consideration the price at which uncontrolled oil can be sold is $12.50 per barrel, and the ceiling price on controlled oil production is $5.00 per barrel. For simplicity, it is assumed that production increases to 300 barrels per day immediately after the investment takes place, remains at that level for 10 years, and drops to zero after that time. (In a real situation, production would increase slowly to a peak and then fall off).[81]

The first situation illustrated is that in which the property is not subject to price controls, perhaps because it was

developed after 1972. Then the investment would increase annual revenues from $684,375 ($12.50 × 150 barrels/day × 365 days) to $1,368,750. The increase in revenue is $684,375.

That increase in revenue represents a 24 percent rate of return on the $2.5 million investment. If the operator requires a 20 percent rate of return to adopt the project, he will proceed with the enhanced recovery investment.

The second situation is one in which the first 150 barrels per day of production must be sold at $5 per barrel, but any production above that level can be sold at $12.50 per barrel. Then adopting the project would increase annual revenues from $273,750 ($5 × 150 × 365) to $958,125 ($5 × 150 × 365 + $12.50 × 150 × 365). The increase in revenue, $684,375, is exactly what it was in the first situation, because all additional production can be sold at the uncontrolled price. Consequently the investment decision will be the same as well.

The third situation is based on the assumption that the 1972 production level for the property was 250 barrels per day, so that only oil produced in quantities greater than 250 barrels per day may be sold at market prices. It is assumed that no cumulative deficiency exists.

Now installation of enhanced recovery will increase revenues from $273,750 ($5 × 150 barrels per day × 365 days) to $684,375 ($5 × 250 barrels per day × 365 days + $12.50 × 50 barrels per day × 365 days). The increase in revenues is now $410,625, which represents only a 10 percent rate of return on the initial investment (because those revenues last only 10 years). Consequently an operator who requires a 20 percent rate of return will reject the enhanced recovery project.

In the final situation, "released" oil is introduced, and it is still assumed that 1972 production was 250 barrels per day. Then the enhanced recovery project would create 50 barrels per day of new oil (300-250) and also release 50 barrels per day of old oil from controls.

Revenue would increase, if enhanced recovery were undertaken, from $273,750 (as in the previous situation) to $821,250 ($5 × 200 barrels per day old oil × 365 days + $12.50 100 barrels per day new and released oil × 365 days). The increase in revenue than is $547,500, giving a rate of return of 18% on initial investment. Thus it may be seen that even with the incentive provided by released oil, the distance between current production rates and the rate that must be achieved to qualify added production for uncontrolled prices is too great. The enhanced recovery project is again rejected.

Efficiency Losses from Crude Oil Price Controls

It is necessary to distinguish between four cases in evaluating the effects of price controls. Oil properties can be classified as

- properties developed in 1973 or later
- properties producing at a rate less than or equal to the rate which would qualify additional output for sale at uncontrolled prices
- properties on which new and released oil is produced
- properties that would qualify for the stripper well exemption.

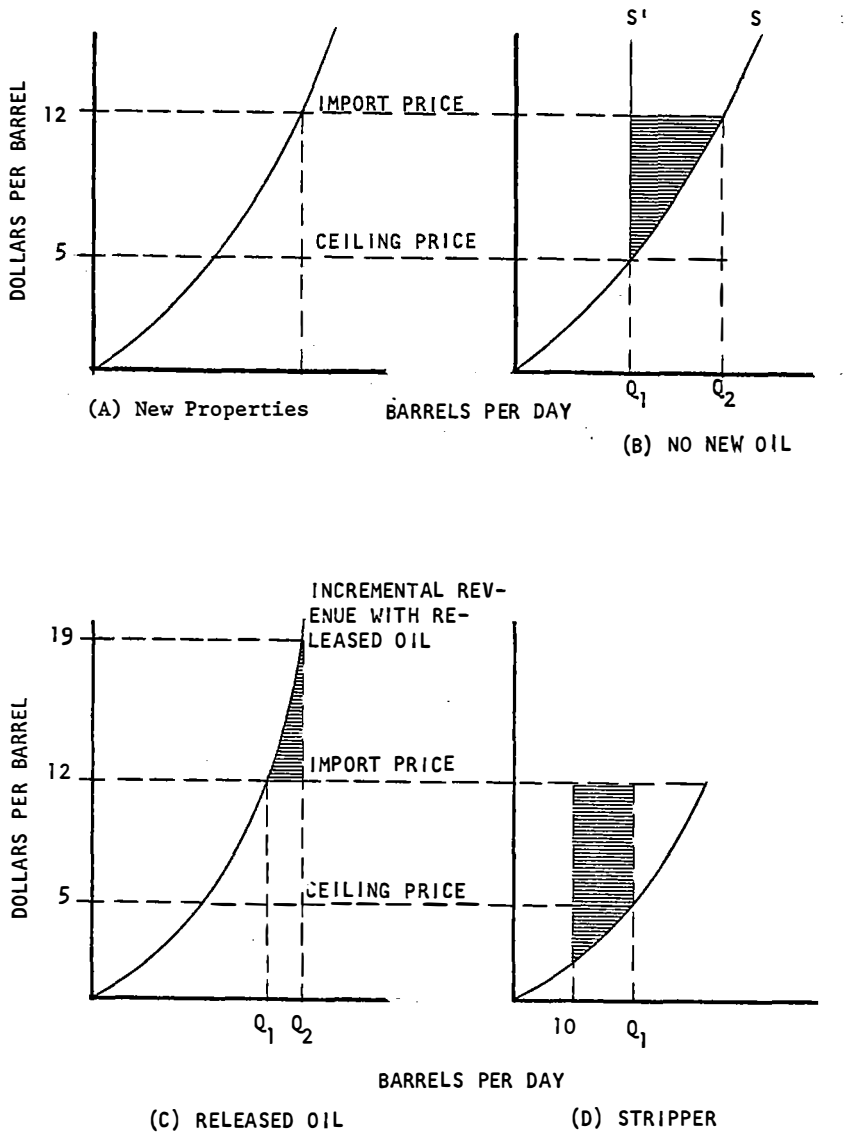
New Properties

Any property that was not in existence, or on which oil was not produced, during 1972 was exempt from price controls until January 1976. The entire production from such a property would be sold at prices roughly equal to the price of imported oil. Production from these properties would respond to changing import prices, with more production forthcoming when prices increase. The supply curve for this portion of the market is depicted in Figure 10a. These properties satisfy the preconditions for efficiency in crude oil production: production will take place at the rate at which marginal cost equals the price of imports.

Properties Producing No New Oil

A second group of properties are those which produced no new oil but did not qualify for the stripper well exemption. Unwillingness to invest in enhanced recovery methods on these properties might result from actual production rates significantly below 1972 levels or from a large cumulative deficiency. Either circumstance could result in a situation in which the loss incurred by selling some of the increased output resulting from advanced recovery outweighed the profits to be earned selling the remainder at market prices. On such properties production of oil would be unresponsive to changing import prices. It would be no higher if the price of uncontrolled oil were $12 per haul then it would be if the market price were $5.00 per barrel. Thus the supply curve for old oil will be the curve S´ in Figure 10b rather than the curve S that would represent production from old

Figure 10
Efficiency Losses from Price Controls



fields absent controls.

Oil production on such fields is set at the low level which results in marginal costs equal to the ceiling price. If all the oil produced on such fields could be sold at the higher price of imports, more would be produced -- Q_2 rather than Q_1 in Figure 10b. All of the incremental oil, Q_2-Q_1, would cost less than the oil which is imported to satisfy demand in its stead. The additional cost incurred to obtain crude oil is equal to the shaded area in Figure 10b. It equals the difference between the cost of purchasing Q_2-Q_1 barrels of imported oil and the cost of producing Q_2-Q_1 barrels domestically.

Properties Producing New and Released Oil

If it is profitable to produce new oil at all from properties existing in 1972, it will be profitable because of the relased oil rule to produce beyond the point at which marginal cost equals the controlled price. With the prices assumed in Figure 10c, released oil will take production on some properties up to the level at which marginal cost equals $19 per barrel. This cost is greater than the marginal cost of oil from new fields or of imports. The excess cost incurred in obtaining oil in the shaded area in Figure 10c, which equals the amount by which the cost of producing the quantity Q_2-Q_1 exceeds the cost of imports.

Properties Producing Stripper Well Oil

Any property with an established production rate which averages less than ten barrels per day per well was exempt from price controls. The

rationale for this exemption was based on the high unit costs that could be incurred to maintain production from a property in the last stages of its life cycle. If price ceilings were applied to such wells, they might be closed down completely when some additional recovery was still warranted. Stripper well oil is a significant part of domestic production, with a share of about 13 percent in 1975.

The stripper well exemption can, as described previously, give an incentive to reduce output to qualify as a stripper well. In Figure 10d such a case is illustrated.

The net economic loss from decreasing production is the shaded area in Figure 10d. Instead of producing domestically a quantity of oil equal to Q_1- 10 barrels per day, at an average cost less than the ceiling price, oil is imported at a cost of $12 per barrel.

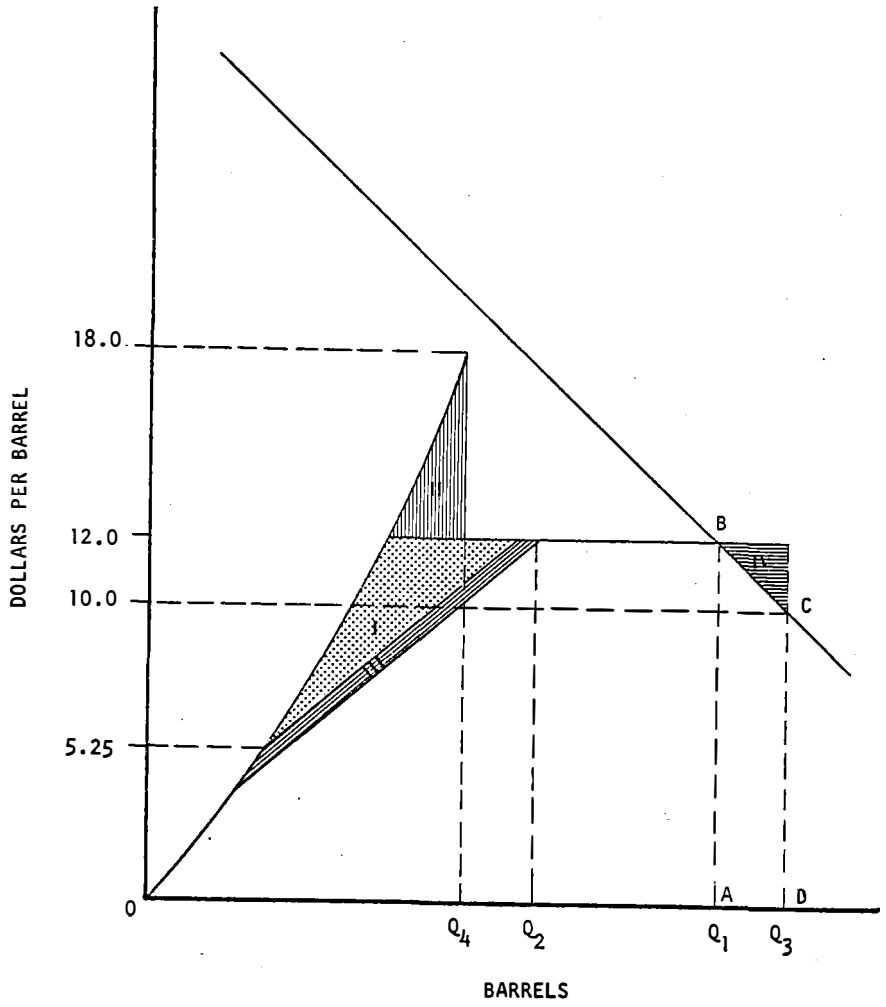
The measures of efficiency loss due to price controls can be brought together in a single crude oil supply-demand diagram based on December 1975 prices and quantities (which will also be used to characterize the effects of price controls on demand).

Each of the marginal cost diagrams used in the discussion of crude oil production characterized a single property. Aggregating them over all properties gives the supply relation of Figure 11. The three shaded areas next to the supply curve corresponds to the efficiency losses identified earlier. They are identified with Roman numerals, explained below:

I: efficiency cost of limiting output on fields not producing new oil

II: efficiency cost of producing oil at high cost on properties

Figure 11
Summary of Efficiency Effects of Price Controls



qualifying to sell new and released oil

III: efficiency cost of incentive to reduce output to qualify as stripper well

Only I, the efficiency cost of limiting output on fields producing only old oil, can be estimated quantitatively. Given the long distance which some fields had to go to be able to sell any oil at uncontrolled prices, continuation of the two tier price system into the future without revision could have posed an obstacle to use of more expensive enhanced recovery methods.

An FEA study performed in 1975 found that about 50 percent of crude oil produced in the United States was derived from fields using some form of advanced recovery. Most of that production was with conventional techniques, investment in which FEA found would continue to be profitable under price controls. The FEA study constructed an upper bound estimate of the increase in oil production that would result from the incremental production from all enhanced recovery projects being freed from price controls by assuming that enhanced recovery would be zero on controlled fields. This resulting loss was 1.3 million barrels per day.[82]

Other estimates have been considerably lower. A study for the Environmental Protection Administration concluded that enhanced recovery might increase oil production by as little as 350,000 to 400,000 barrels per day in 1980.[83]

If price regulation were to prevent all investments in enhanced recovery on old fields, the loss in production due to price controls would equal the enhanced recovery potential of those fields.

The studies cited placed that potential in the range of 300,000 to 1.4 million barrels per day. For a mid-range estimate, one might assume that 750,000 barrels per day of additional production could be achieved after several years of investment in enhanced recovery at an average cost of $7.50 per barrel. If this increased oil production were substituted for imported oil costing $12 per barrel (a reasonable 1975 figure), the saving would be something over $1 billion per year. Thus the area ABC is a cost of about $1 billion.

The loss might actually range from $2 billion to less than $500 million. Lower figures are more likely because by 1975 some fields presumably retained an ability to sell an adequate fraction of increased production at uncontrolled prices, whereas the estimates are based on the assumption that none could do so.

No quantitative estimates of the increase in oil production due to released oil exist; nor do estimates of the decrease in production due to the stripper well provision. Consequently, it is impossible to even guess at the magnitude of the resulting efficiency loss. Because released oil does not exist under current regulations, the exact magnitude of the loss caused by released oil is of little relevance to current decisions. Both the stripper well provision and the incentive to reduce output while prices are rising, however, continue.

Domestic oil production with crude oil price controls in 1975 was Q_4, probably less than production without controls (Q_2) because of the declining ability to produce new and released oil from existing properties.

Crude Oil Prices and Oil Demand

Because of the entitlements system, each refiner perceives the cost of additional crude oil imports as equal to the average cost of crude oil. That average cost is actually a weighted average of the prices of controlled, uncontrolled, and imported oil. As discussed previously, competition would make refined product prices equal to the sum of refining costs and the cost of incremental crude oil supplies. With no price controls, incremental cost would equal the price of imports. With price controls and entitlements, it equals the lower average cost of crude oil.

Efficiency in the use of petroleum products requires that all consumers pay a price based on the cost of imported oil. With price controls and entitlements, however, consumers pay less than the full price of crude oil that they cause to be imported. Consequently consumption decisions are not based on the real economic trade-offs involved in petroleum use. Since prices of petroleum products are below the cost of the oil that must be imported to satisfy demand, consumers will use petroleum products in applications in which the benefit to the consumer is less than the cost of imported oil. More oil will be consumed than would be if prices were established on unregulated markets. The magnitude of the resulting loss depends on how demand responds to price.

One measure of the efficiency loss due to the effect of price controls and entitlements on demand is illustrated in Figure 11. Efficiency loss is equal to the difference between what it costs to import a certain quantity of oil and the amount that consumers are

actually willing to pay to have that amount of oil. This difference is equal to the triangle labelled IV in Figure 11 which may be estimated by subtracting total willingness to pay for the quantity Q_3-Q_1 (the area of ABCD) from the total cost of that quantity of imports. Q_1 is demand for all in the absence of controls, while Q_3 is demand with price controls and entitlements. Q_3-Q_1 equals the increase in imports that results from average cost pricing of crude oil.

To estimate that welfare loss estimates of the price elasticity of demand for crude oil are required. Removal of controls in 1975 would have increased average crude oil prices by about 34 percent.[84] Crude oil consumption in 1974 was 6 billion barrels.[85] If a one percent increase in price reduced demand by 0.36 percent (a price elasticity of -0.36) removal of controls would reduce demand by 734 million barrels (.36 × .34 × 6 billion barrels.) Thus the amount paid for imports -- since such a reduction in demand would create an equal reduction in imports -- would fall by $10.2 billion. To estimate the welfare improvement that results from the reduction in imports, it is necessary to subtract from $10.2 billion the value consumers would place on their foregone consumption. That value must be at least $10.38 per barrel, since that is what consumers were paying (through refiners) for crude oil, or $7.6 billion. Thus welfare loss when the price elasticity is .36 is no larger than $2.6 billion, and probably less. It would be less because consumers would very likely be be willing to pay more than $10.38 (but less than $13.93, the work market price) for some of the oil consumption which is foregone when prices rise. Taking this effect into account and assuming constant

price elasticity suggests that the welfare loss from increased imports is on the order of 1.4 billion.[86]

A price elasticity of .36 is a middle ground estimate. Some authorities have estimated elasticities as low as .1, and others as high as .5.[87] That range of elasticity estimates implies that welfare loss could be between four hundred million and two billion dollars annually. Based on 1980 demand projections at various prices reported in FEA's 1976 National Energy Outlook, the loss would be under $1 billion per year.[88]

Redistribution of Wealth

In addition to their efficiency effects, oil price controls transfer purchasing power from owners of oil properties to consumers of petroleum products. During 1975 that transfer amounted to about $14 billion.[89] (= $7.50 price differential times 1.8 billion barrels of old oil production.)

If price controls were continued to 1985, production of controlled oil would decline due to the natural deterioration of fields. Taking a high estimate of the decline rate (13.5 percent per year),[90] old oil production in 1980 would be about 50 percent of 1975 production. The income transfer in that year would consequently be about $7 billion. From the point of view of consumers, the perhaps $2 billion efficiency loss was definitely overshadowed by the income transfer.

Encouragement of Imports

When the vulnerability of imports to embargo or sudden price

increases are taken into account, an additional potential economic cost of price controls appears. The price of imports probably underestimates their cost to the economy, in that they bear with them a risk of future economic harm. By adding to the price of imports a "supply interruption premium" equal to the expected present value of the harm that would be done by an embargo which made it impossible to obtain that barrel of oil, an estimate of the true cost of imports would be obtained. The complexities involved in determining that premium are beyond the scope of this report. But any such premium would increase the economic loss due to reduced domestic production and reduce the loss associated with released oil. The change would equal the premium times the amount of imported oil involved. As long as the effects of released oil on production are less than the effects of price regulations that tend to reduce production, introducing a supply interruption premium increases the economic loss due to price controls.

PRODUCT PRICE CONTROLS

Even if refined product price controls were completely ineffective, crude oil price controls would hold the cost of refined products to consumers below the levels that would exist in the absence of all price controls. Whether or not refined product price controls have any effect on the efficiency of resource allocation in oil refining, marketing or consumption depends on whether those controls do anything not also done by the crude oil program. Thus the first question that arises in evaluating refined product price controls is whether they are effective, in the sense of holding the prices received by a refiner below the levels that would be established in an unregulated

refined products market given the existence of crude oil price controls and entitlements. There are three possibilities: all, some, or no refiners face effective price constraints.

Consequences of Effective Controls

If all refiners were forced to sell at prices below those that would clear the market, demand at the legal price would exceed supply. All refiners would be able to produce additional products at prices less than those consumers were willing to pay for the additional output, but refiners would find that production unprofitable at controlled prices. Such a situation represents a clear loss in economic efficiency. Some kind of allocation program would also be required to distribute the inadequate supplies among potential customers.

A less obvious type of problem could occur if effective price ceilings were high enough to balance supply and demand in the short run but failed to provide an adequate incentive to expand refinery capacity in the long run. Refinery capacity increased less than two percent between January 1975 and January 1976;[91] some industry sources claim that limitations on the recovery of certain non-product costs prevent them from earning an adequate return on increased capacity. During 1974 and 1975 not all expenditures that an economist would consider costs could be used to revise price ceilings. The definition of "non-product" costs does not include all adjustments necessary to maintain a competitive rate of return. Although interest charges may be passed on,

increased cost of equity capital (a less precise concept, to be sure) may not be translated into higher prices. With rising interest rates and difficulties of raising equity capital since 1973, that restriction adds up to difficulty in earning a sufficient return on investment in additional refining capacity to justify expansion. A similar problem arises from being unable to pass through increased depreciation charges occasioned by inflation or additional investment.

According to testimony by an Exxon spokesman, FEA regulations in late 1974 would allow a new facility to earn a profit margin only about one-half as large as that required to provide a ten percent return on investment. Exxon concluded that

> "Price controls in their present form, which restrict refiners to historical margins plus an incomplete recovery of additional costs, are clearly inadequate to justify the higher level of investments and operating costs faced by refiners planning new facilities at this time."[92]

The same source pointed out another problem that could result from price ceilings based on crude oil costs,

> "... lower quality crudes normally cost less to purchase but require higher investment and operating costs to make the products required by consumers. The lower purchase price is normally the incentive to incur the costs. However, current regulations require the lower crude price associated with lower quality crudes to be passed through as lower product prices and at the same time, do not make adequate allowance for recovery of the higher investment and operating costs"[92a]

There is, however, evidence that price ceilings are not effective for <u>all</u> refiners. FEA regulations provide for the "banking" of increased costs which refiners, for any reason, are unable to pass

on to their customers. Subject to some restrictions, these banks can be applied to raise prices at any time that market conditions permit. Consequently the existence of cost banks, data on which is provided in Table 7, implies that refiners could increase prices if they wished. Any refiner with cost banks would therefore be free of effective price controls.

Some caution must, however, be exercised in interpreting the data in Table 7 as evidence that price controls are not generally effective. There is some seasonality in the size of banked costs, due to reasons other than market prices being at a level below statutory price ceilings. During late winter and spring, for example, some refiners increase their gasoline output and store excess production for sale during the high driving season. Such refiners would build banks if, for example, crude oil prices increased during late winter and spring and would not recoup those cost increases ("draw down banks") until mid-summer.[93] Moreover, the total $1.2 billion in unrecouped costs is only about one-half the costs which <u>are</u> recouped in any typical month.[94]

<u>Consequences of Partial Effectiveness</u>

Even if cost banks demonstrate that price ceilings are not effective on all refiners, they may be effective on some. This situation could occur if different refiners were to incur different cost increases or began with different base prices.

To describe this situation it is necessary to begin with a general analysis of the effect of price controls on refiners' output decisions. If unit costs of refining increase as the output of a refinery of fixed capacity increases, a point will be reached at which

Table 7

Unrecouped Costs for Refined Products for 30 Largest Refiners

		Distillate	Motor Gasoline	Aviation Jet Fuel*	Other Products	Total
				Millions of dollars		
1974	January	116	91		43	250
	February	184	87		175	446
	March	198	85		237	520
	April	223	215		346	783
	May	261	255		446	963
	June	326	394		630	1,350
	July	355	325		648	1,327
	August	392	349		665	1,405
	September	409	431		650	1,490
	October	295	424		531	1,250
	November	245	475		595	1,315
	December	209	413		492	1,114
1975	January	254	431		672	1,357
	February	300	418		790	1,508
	March	282	452		966	1,700
	April	302	485		807	1,594
	May	292	370		771	1,433
	June	284	266		785	1,334
	July	233	219		624	1,075
	August	280	344		583	1,208
	September	347	335		661	1,342
	October	338	245		673	1,255
	November	426	275		796	1,497
	December	446	211		826	1,483
1976	January	336	242	131	515	1,224

*Prior to January 1976 refiners were not required to maintain separate banks for aviation jet fuel.
Source: FEA.

Source: FEA Monthly Energy Review, July 1976, p. 66.

the refiner would obtain reduced profits if output were expanded further. If the controlled price is below the market price, that point will be reached at a lower output than would be the case without price controls. Consequently effective price controls tend to reduce refinery output. Price ceilings above market prices do not affect output decisions.

If two refiners have different ceiling prices (for the same product in the same location), the refiner with the lower ceiling price will, if the ceiling is effective, produce less output than it would if it were allowed to sell at the higher ceiling price.

Unit costs of the refiner with a higher price ceiling will be greater than unit costs of the refiner with the effective lower price ceiling, because each refiner will adjust its output until the cost of increasing output by one barrel equals the price it receives for one barrel of output. Suppose, for definiteness, that one refiner faces an effective price ceiling of $10 per barrel, while the other is charging a price of $15 per barrel that is less than its price ceiling. Then the first refiner could increase its output a small amount at an average cost, per added barrel, of about $10. The second refiner would, if it reduced output a small amount, reduce its costs by about $15 per barrel of reduction. Thus by shifting some customers from the high cost to the low cost refiner, the same demand could be satisfied at lower total cost.

Consequently, when some refiners face effective controls and some do not, supply of petroleum products is less, at the price paid by customers of the high cost refiner, than it would be without

controls. Removal of controls would cause some prices to fall in particular, those charged by refiners not subject to controls. At the same time, removal of controls would allow prices received by other refiners to increase.

The net effect of removing price controls would be to increase the economic efficiency of the refining sector, by reducing the share of high-cost refiners and increasing the share of low-cost refiners.

This conclusion regarding refining efficiency must be qualified by noting that some refiners have relatively low costs, and may have low price ceilings, because they benefit from the small refiner bias in entitlements. Since their lower cost does not derive from more efficient operation, price controls that prevent such refiners from exploiting their lower cost to increase sales need not cause a decrease in economic efficiency.

Because of the purchaser-supplier freeze, the low-cost refiner must first offer its output to its historical customers. Those customers are likely to purchase their entire allocation, because of its advantageous price. Customers historically associated with the high-cost refiner are unlikely to be able to obtain any products from the low cost refiner unless it has surplus product. Different consumers will thus face different prices for identical products. The result of such differential pricing is likely to be misallocation of products among customers: those assigned to the low cost refiner will be encouraged, up to the limit of their allocation, to make less valuable use of products than would be made by the customers facing the higher price

of the second refiner. In the case of motor gasoline, discussed below, the situation is somewhat different because no purchaser-supplier freeze gives historical retail customers easier access to low priced dealers.

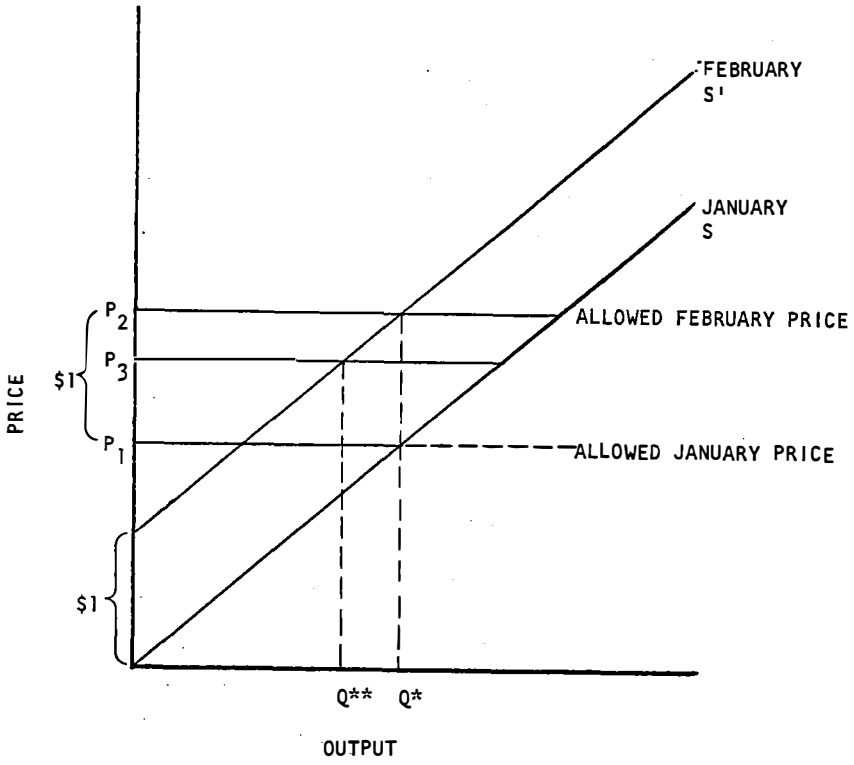
Possibility of Ineffective Controls

The final case to be considered is that in which all refiners are in effect free of controls, because ceiling prices are above market levels. There is some sentiment that when refinery price controls were first established, product prices were very high and were providing unusually large profit margins. If this were true, the ceilings might have been and might remain ineffective for all refiners -- and thus have no effect on price or efficiency. Even if price controls started out giving just adequate profit margins, steadily increasing costs would tend to drive price ceilings above market price levels.

This tendency can be illustrated by means of a drastically simplified analysis of refined product supply and demand. It is assumed that there are only two refiners, each of which produces only one product and sells it at a single price to all groups of purchasers. It is also assumed that increased costs are immediately reflected in a revised price ceiling.

Figure 12 represents two months in the history of one refinery. The refiner is allowed to charge a price P_1 in January. Given January costs, the refiner's supply curve is the curve S. Between January and February, the cost of crude oil to that refiner increases by $1 per barrel. Then if there are no losses of crude oil in refining, the refiner will continue in February to sell the same quantity sold in January only if the price of refined products is increased by $1.00. That is, the supply curve is shifted up by $1 to S^1.

Figure 12
Price Controls in Refiners



FEA regulations allow refiners to increase prices so that their revenues will be increased in a total dollar amount exactly equal to their increased costs. If there is no lag in recouping costs and if there are no losses of crude oil in refining, the regulations would allow a $1 per barrel increase in crude oil costs to be reflected in a $1 per barrel increase in refined product prices.

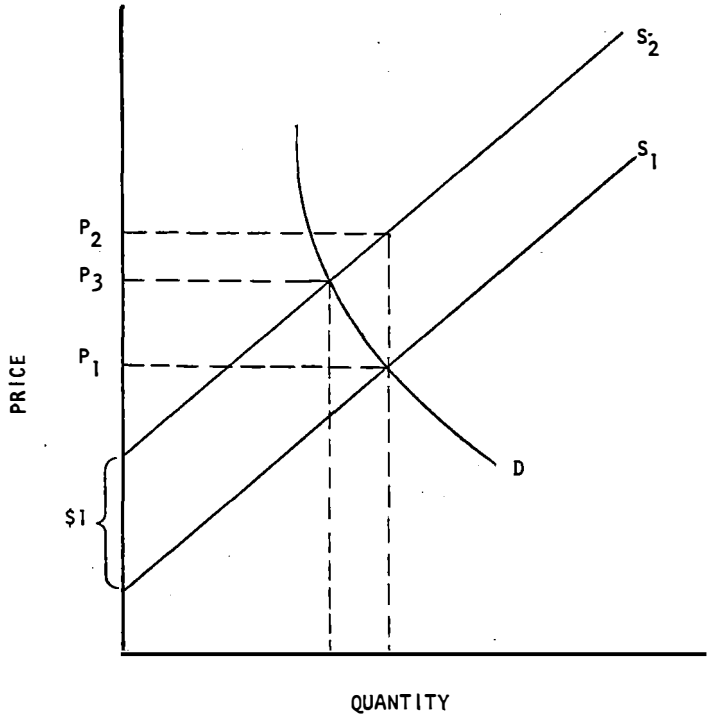
If the refiner received a $1 higher price in February, it would continue to produce Q^*, and increased revenues would exactly equal increased costs.

If all refiners are identical, however, and each is allowed to increase its ceiling price by $1, none of the refiners will be able to raise their actual price to the ceiling. The reason is that if demand is at all responsive to price, the market will taken less refined product when its price is increased.

In Figure 13 market equilibrium is depicted, on the assumption that P_1, the January ceiling price for each of the identical refiners, exactly equals the market clearing price. The market supply curve S is the sum of the supply curves of each independent refiner. When that curve is shifted up $1, to S_2, the market clearing price rises only to P_3 -- which is less than the new ceiling price P_2, which equals P_1 plus $1.00.

Returning to Figure 12, it is seen that the individual refiner must offer his product for sale at less than the ceiling price and will supply only Q^{**} The increased costs which the refiner is allowed to recoup are equal to the increased crude oil price (P_2-P_1= $1) times the quantity of crude oil produced in January, Q^*. Since the

Figure 13
Supply and Demand for Refined Products



refiner is actually able to charge only P_3, all the allowable costs would not be recouped. Unrecouped costs may be "banked" and passed on to consumers in the form of higher prices when demand conditions permit. In this case, the refiner would bank $(P_1 + \$1) - P_3$, the difference between ceiling and market prices, times the amount of crude oil purchased (and product sold) in February.

This is exactly what would happen without regulation. In any increased costs tend to be shared between buyers and sellers. Consumers bear a larger share of costs of demand if unresponsive to price and a lower share if demand if very responsive. Only with perfectly inelastic demand could all costs be passed on, with or without price controls.

This simple analysis ignores one essential feature of FEA regulations, that costs may be reflected in higher price ceilings only after they have been incurred. The regulations only allow price ceilings in <u>future</u> months to reflect <u>current</u> cost increases. That delay can make it impossible for refiners to recover even the portion of costs that would be borne by consumers if prices were increased immediately. Because of this lag, refiners' profits may be reduced by price controls even though cost banks are large and growing.

Market prices, unlike price ceilings, are based on current and prospective costs. If, for example, there were a cost increase in January alone, while in February costs fell back to their December level, refiners would be allowed to increase their prices in February to recover January costs. However, with constant demand and adequate refining capacity, no refiner would be able to charge the ceiling

price in February: the entire cost increase would have to be banked.

To be more specific, suppose that during December a refiner paid $10 per barrel, or 24¢ per gallon for crude oil, and that during January its costs increased to 29¢ per gallon because of a disadvantageous price being paid for several tanker loads of imported oil. In February, the cost of oil returned to its past 24¢ per gallon level. The refiner would be allowed to increase February product prices by an average of 5¢ per gallon (if projected February sales equalled January sales). Even if all refiners were in this position, none could charge more in February than they charged in January. In February, each refiner would be facing a cost of production equal to the cost of crude oil plus operating cost, say 10 cents. If all refiners declared a 5 cent per gallon price increase in February, the higher market price would cause demand for each refiner's products to begin to fall below projections. To maintain their projected output levels, which would be profitable in February at prices of 34¢ per gallon (current crude oil costs of 24¢ plus 10¢ operating costs) refiners would begin bidding down the market price. Eventually market prices would be bid down to exactly their December level, and no January costs would be recouped. If demand rose some costs could be recouped.

Constant fluctuations in crude oil prices probably do at times create this situation, in which price controls prevent cost increases from being reflected in higher prices immediately and competition prevents them from being recouped when price ceilings are raised.

However, the general upward trend in average crude oil costs, due to rising prices of imported oil, will serve to cause market prices,

to rise, although at a rate somewhat slower than the rate of increase in crude oil costs. If the 5¢ crude oil cost increase that was assumed to occur in January were due to a permanent increase in the cost of imports, all refiners would have to charge 39 cents in February to cover costs of production in February. If, in addition, the demand schedule for products rose sufficiently in February to keep each refiner's sales at their January level despite the price increase, the January cost increase could recouped; if the same cost situation existed in March and demand was strong enough to allow all refiners to maintain sales at higher prices, February costs would be recouped; and so on throughout the year.

In other words, a permanent cost increase will, eventually, be recouped to the extent that demand permits. As in the simple example in which it was assumed that costs were recouped without delay, the sensitivity of demand to price may prevent all costs from being recovered. Indeed, once a cost bank is established the refiner can pass on cost increases immediately, until banked costs are exhausted.

Only in a month during which the price ceiling is binding — i.e., a month in which a refiner has no banked costs -- do price controls prevent crude oil costs from being passed on by the normal market mechanism. Even in normal, unregulated markets, only growing demand can allow a refiner to increase total revenues at the same rate that total costs would increase if output were constant.

Because of the lag in recovering costs, the demand curve may shift up sufficiently that market prices would be above the level required to recover past cost increases. Thus it is not inevitable

that cost banks will grow when permanent cost increases are incurred. It is more likely that banks will grow subsequent to temporary cost increases, but even then rising demand might allow market prices to rise sufficiently to cover past costs.

It would, in either case, be the current level of costs and demand, not the existence of unrecouped costs from previous months, that would cause the rise in market prices. The cost bank would only be permissive, allowing prices to increase if market conditions permitted.

It also follows from this analysis that even if cost banks exist, a drop in refiner's acquisition cost of crude oil will cause product prices to fall below the level they would otherwise attain.

"Ripple" Effects

An argument advanced for product price controls is that they are required to reduce the "ripple effect" of price increases at earlier stages of production and distribution. The ripple effect theory rests on the assumption that sellers retain their percentage mark-up over costs when costs increase, so that a crude oil price increase, for example, is magnified as it is passed down the chain of resellers. This theory is inconsistent with the principle that profit margins are set, in a competitive industry, at the level which provides just the minimum acceptable rate of return on invested capital. Under some conditions, a fixed dollar markup will provide the same rate of return when costs increase. In other cases some increase in markup may be required to restore the rate of return to an acceptable level, but a

constant percentage markup will rarely be required.

Suppose, for example, that the price of crude oil is increased. Then refiners and all later sectors will find their cost curves shifted up by the increased crude cost. Other costs may also increase; for example, since inventories are more valuable, inventory carrying costs will increase. Thus the increase in the cost of producing any fixed level of output will be greater than the dollar-for-dollar passthrough of increased crude costs. In a competitive industry, prices will equal costs, including a market rate of return on invested capital. If inventory costs are not allowed under product price controls, those controls will keep product prices below what they would be without controls.

However, price increases without controls would be restricted to the increased cost due to an earlier (crude producing level) cost increase, and nobody in the petroleum industry affected by those costs would obtain a higher rate of return. The "ripple effect" theory overestimates price increases and, to some extent, misrepresents cost increases as profit increases. Moreover, price controls that prevent secondary cost passthroughs simply squeeze the sectors affected by primary cost increases, with a long run detrimental effect on investment in those sectors.

Conclusion

The only widely available piece of evidence regarding the effectiveness of price controls, the size of the backlog of unrecouped costs, suggests strongly that not all refiners are subject to effective

controls. If some are subject to effective controls, an inefficient pattern of unequal prices for similar products is likely to result. Even if all refiners have banks of unrecouped costs, the delay in recovering increased costs may reduce refiners' profits. These reduced profits could, as in the case of effective controls on all suppliers, diminish the incentive to expand capacity. As noted earlier, these efficiency losses are not balanced by any broad distributional gains. Reductions in crude oil cost using crude oil price controls and the entitlements system could achieve any average reduction in product prices that are achieved by means of direct produce price controls.

The only reason that refiners could even for a short time capture the benefits of lower crude oil prices would be an absence of adequate refining capacity. Once demand caused refineries to press close to capacity, prices might be bid up without additional output being produced. That situation is unlikely at present since 1974 refineries have been running at a lower percentage of capacity than in any year since 1962.[95]

No quantitative studies that would make possible estimates of the magnitude of efficiency losses associated with refined product price controls are available, It has only been possible to identify the tendencies that would result from effective controls, and the uncertainty that exists regarding their effectiveness.

ALLOCATION PROGRAMS

With multiple prices for identical products, which result from FEA controls, some form of allocation is required to prevent all

customers from flocking to the lowest cost supplier -- who would have incentive and opportunity to find ways around price controls.

However, the purchaser-supplier freeze may create problems of its own. FEA has frequently claimed that the freeze reduces competition by inhibiting the movement of customers from one supplier to another,[96] making it more difficult for purchasers to search for and find other suppliers. In so doing it would restrict price competition even if price ceilings were everywhere above market prices. Historic customers would have an advantage over others in obtaining products from low cost suppliers, while customers assigned to high cost suppliers would find it difficult to change suppliers. For example, the freeze has made competitive bidding for large long-term fuel oil controls nearly impossible.[97] Because in the event of a fuel oil shortage suppliers could be required to cut off all but their assigned customers, suppliers were deterred from entering into long term contracts with any but their assigned customers. To be transferred by FEA from one supplier to another, a purchaser needed the acquiescience of both. Thus a historical supplier might block transfer of a customer to a competitor who underbid him.

Performance of FEA Regulations During the Embargo

The price controls and allocation programs developed under Phase IV and continued under the EPAA were directed at other goals than economic efficiency. Mitigating the effects of the Arab oil embargo on oil markets and particularly on the structure on the oil industry are achievements that could be balanced against the efficiency

losses that appeared when markets returned to their normal condition by mid 1974.

A rather lengthy quotation from the "History of Petroleum Price Controls" written by a participant in FEO regulatory activities gives one view:

> In a sense, then, it was fortuitous that Phase IV's CLC mechanism was in place and in force when the major disruption of the Arab embargo and production cutback hit the world and U.S. supply. The existence of this price control mechanism, and the imminent congressionally-mandated crude oil allocation program, was of tremendous significance in the accommodation the U.S. was able to make to the supply situation with which it was faced.
>
> A comparison of wholesale price movements in the U.S. and abroad indicates how much less the country was subject to drastic swings in the prices of major products. One advantage was that, relative to most other industrial countries of the world, the U.S. is primarily dependent for its oil supply on indigenous production and the bulk of that production was price-controlled under Phase IV and the two-tier system. The other advantage was that the cost passthrough system allowed purchasers of incremental product to compete in the world market and yet essentially made certain that they would not reap large windfall profits as a consequence.
>
> . . . . . .
>
> The flexibility of the cost pass-through system, designed and monitored as it was, constituted a major element in the viability of the program of Phase IV controls. No effective allocation system had yet been set up, and there was [sic] -- as there still are -- substantial rigidity problems in any volume allocation system under severe supply stringency.

> . . . . .
>
> Perhaps the most salient feature of the pattern of controls developed under Phase IV was that, while not designed for the extreme shortages and dislocations of the Arab embargo, they were flexible and effective enough to prevent either runaway prices or crippling shortages of particular products. The ultimate step of rationing, with all its costs and inevitable problems, was avoided. And while there were hardships and even some inequities in particular cases, the essential goals of preserving a viable industry structure without crippling increases in costs of the economy were achieved.[98]

Richard Mancke, on the other hand, argues that FEO allocations of gasoline and controls on use artifically increased the shortage, and resulted in larger stocks of crude oil products at the end of the emgargo than at the beginning. He points out that in October 1973, stocks were 27 million barrels below their level in October 1972, whereas by April 1974 (the end of the embargo) stocks were 52 million barrels above their April 1973 level. Mancke computes the reduction of oil imports due to the embargo as 130 million barrels, and the additional reduction in supply due to FEA's restraint on sales are 80 million barrels [99]. George Perry concurred in the conclusion that FEA policies exacerbated the shortage of gasoline.[100]

The two authors also concluded that some gasoline shortages arose from rigidities in the allocation program. Because allocations were based on a uniform fraction of 1972 sales, some consumer regions were allocated more than their projected needs and others considerably less.[101]

There is however, substantial sentiment that the allocation program preserved the independent sector of the oil industry. According

to F.M.Scherer, "after some initially counter-productive steps, FEA regulation has lessened the danger of a crude oil price or quantity squeeze on non-integrated refiners."[102] Testimony of numerous witnesses from the independent sector of the industry also supported this view.[103]

SUMMARY: THE EPAA REGULATORY PROGRAM

At this point a recapitulation of the nature and consequences of the regulatory program that evolved under the Emergency Petroleum Allocation Act is in order.

The regulatory program had four major parts:

- crude oil price controls
- crude oil allocation and cost equalization
- petroleum product price controls
- petroleum product allocation

The Cost of Living Council created a two-tier price system for all domestic crude oil. Imported crude oil was exempt from controls. "Old" oil was defined as oil produced from a property -- roughly the same as a lease tract -- in quantities less than 1972 production levels on that property. The price of old oil was set at the posted price in effect on that field on May 15, 1973, plus $1.35 per barrel. That rule resulted in an average price of old oil of about $5.00.

Crude oil produced in excess of 1972 production levels from the same property ("new oil") and oil from properties that averaged less than 10 barrels per well per day was exempt from controls. In addition, each barrel of new oil produced "releases" one barrel of old oil from controls. By December 1975, uncontrolled oil was selling

at a price of about $13 per barrel. Because of "released" oil, the additional revenue generated by producing a barrel of new oil was about $21 -- the price of new oil plus the increase in the price at which old oil could be sold.

For a time, that additional revenue may have induced some producers to adopt inefficient production techniques to extract oil as rapidly as possible. However, by the end of 1975 the crude oil price regulations were holding domestic oil production below the level it could have reached without price controls. Estimates of the magnitude of the reduction are uncertain, ranging from 350,000 to 1.2 million barrels per day. The reason that the ceiling became a disincentive is that the unit costs of producing oil from a given field increase over time, so that maintaining any historical production rate becomes more and more expensive. Consequently many properties had 1975 production rates well below their 1972 production rates. In some such properties investments in enhanced recovery projects would have been profitable if the entire increment to production were sold at uncontrolled prices. Because only part of the increment -- that in excess of 1972 production -- could be sold at uncontrolled prices, some of those projects were made unprofitable.

In the absence of price controls, all crude oil would sell at a single price adjusted for quality and location. With the two-tier price controls, different refiners may pay very different prices for identical crude oil. The entitlements program is intended to equalize the cost of crude oil among refiners, and to ensure that the cost a refiner incurs in purchasing a barrel of oil is always equal to the

average cost of all crude oil inputs to refineries.

Price controls on petroleum products establish a ceiling on the price of each product equal to its May 15, 1973 selling price plus a dollar-for-dollar passthrough of increased costs incurred subsequent to May 15, 1973. Costs are divided into product (i.e. crude oil) and non-product costs; product costs are passed through somewhat more easily than non-product costs. The effect of cost passthrough rules is to restrict the ability of refiners to recover increased costs even more than it would be restricted by the operation of competition. Restrictions on the allocation of increased costs among refinery products probably also prevent price differentials from adjusting fully to altered demand conditions.

A substantial loss in efficiency occurred because prices of refined products were set on the basis of average crude oil costs rather than on the costs of incremental oil inputs. If there were no product price controls or entitlements, consumers would obtain no benefits from the price controls on crude oil. Crude oil controls would simply increase refiners' profits, because the price of all refined products would equal the price of the lowest cost source of incremental oil supply -- imports -- plus profits and operating costs.

Entitlements alone would serve, in normal market conditions, to ensure that the price of refined products equalled average crude oil cost plus profits and operating costs. Any system which allows consumers to pay average rather than incremental cost serves as a subsidy to consumption -- in this case to consumption of imports. Any consumer who increases consumption of some refined product pays only

$10.50 -- the 1975 and current average cost of crude oil -- plus markup, but some refiner pays $13.50 for the oil that must be imported to meet the increased demand. One common measure (consumers surplus) of the loss in welfare that would result from a permanent subsidy of this magnitude indicates that the loss is on the order of $1 billion annually.

To these welfare losses one might compare the loss of consumer purchasing power that would result if there were no regulatory program. If controls had not existed, consumer costs of petroleum products would have been about $14 billion higher in 1975.

With the entitlements system, prices of refined products could be held down without product price controls under normal market conditions. By the end of 1975, price ceilings were probably above market levels for many refiners. However, if price ceilings were effective for some, they would create a multiple price system for refined products in which low cost refiners with relatively low price ceilings could not increase output even though they could undersell refiners that had higher costs and higher price ceilings. That situation would be inefficient, but its prevalence is impossible to assess.

The entitlements system also contains a bias in favor of small and independent refiners. The basic bias, supplemented on two occasions by additional preferences, works through the granting of more entitlements, relative to size, to refiners with less than 175,000 barrels per day capacity than are granted to larger refiners. This bias has enabled small refiners, who are major suppliers of independent, unbranded gasoline retailers, to produce refined products at costs up to or lower than those of larger, more efficient refiners.

FEA allocation programs are all based on a purchaser-supplier freeze. All suppliers are required to continue to offer their wares to purchasers with whom they dealt in 1972; the quantities that must be offered are also specified in the regulations. Although purchasers are not required to deal with their 1972 supplier, the freeze may make it more difficult for purchasers to search for and find other suppliers because long-term contracts are only available from 1972 suppliers. Against these problems must be balanced the success of the crude oil allocation program in relieving the pressure on independent refiners and their gasoline marketing customers that existed in 1972 and 1973.

IV: CURRENT OIL PRICE CONTROLS

The Energy Policy and Conservation Act (EPCA) passed in December 1975 made two important changes in oil price regulation: it rolled back the price of some domestic crude oil, creating a "three tier" price system, and it provided for gradual easing of price controls over thirty-nine months beginning in February 1976. In all other respects, EPCA left the prior regulatory program in effect. The price rollback mandated in EPCA was accompanied by a set of energy conservation programs designed to substitute for higher prices in controlling demand and some non-price measures to increase production.

The legislative history of the EPCA makes it clear that Congress intended continued price controls to prevent the macroeconomic disturbances and increased cost of living that would result from a precipitate increase in energy prices. Although protection of the independent sector of the oil industry was not mentioned in the committee reports that accompanied the EPCA, protection established previously was was continued by the extension of price control and allocation programs created by the EPAA.

CRUDE OIL PRICE CONTROLS

The EPCA required the President ot develop a system of crude oil price controls that would result in an average price of domestic crude, at its first sale, of $7.66 per barrel. The proposed system was subject to Congressional veto; by not acting to disapprove, Congress allowed the current program to go into effect on February 3, 1976.

The system of crude price controls that went into effect in February was based on a classification of all domestic crude oil into two tiers. The third tier, imported oil, was not subject to price controls. Stripper well lease oil was also exempted from controls by Congress in August 1976 and became part of the third tier.

The definition of the two lower tiers hinges on the concept of a "base production control level" (BPCL) of oil production. The base production control level for any property is "equal to that property's average monthly production and sale of old crude oil during calendar year 1975."[104]

The definition of old oil in 1975 in turn reached back to production that took place in 1972; "old oil" is synonymous with oil subject to price controls under the system that existed until February 1976.

If the quantity of oil produced on a property does not exceed the base production control level, all oil from that property falls in the lower tier of price controls. If production from a property exceeds the base production control level, the difference between actual production and the base production control level goes into the upper tier, and the remainder (equal to the base production control level) goes into the lower tier.

The upper tier also includes all oil from properties that began production after December, 1972. Stripper well lease oil, initially included in the upper tier, was exempted from controls by Congress in the Energy Conservation and Production Act of 1976, passed in August

1975. However, when the average price of domestic oil -- which must conform to requirements of EPCA -- is computed, all stripper well oil is assigned an upper tier price rather than the price actually paid. This computation, specified in the ECPA, made it possible to increase the price of stripper well oil without lowering the price of some other category of domestic oil.

During the first month of the new price regulations, the average price at which lower tier oil could be sold was $5.07 per barrel; the average price of upper tier oil was $11.44 per barrel.[105] That is, in order to reach an average price of $7.66, new oil had to be rolled back from its January 1976 price of $12.99 per barrel. Actual prices at which crude oil was sold varied widely around these averages. Ceiling prices on lower tier oil were identical to those which existed under the previous control program. The price ceiling on upper tier oil was below the level at which uncontrolled oil sold prior to enactment of the EPCA. The new price ceiling was set equal to the highest posted price for a particular grade on a particular field on September 30, 1975 less $1.32 per barrel.[106]

Unlike previous price controls, controls under EPCA do not provide for released oil. This removes one of the efficiency losses which characterized price controls under PEAA, but it also removes an incentive to use production methods that would extract old oil costing more per barrel than the ceiling price. The elimination of released oil may therefore tend to reduce domestic production and increase imports, especially because the new ceiling price for upper tier oil is less than the market price at which it sold during 1975.

Under the new regulations FEA changed the base production control level from its previous definition, actual production in each month of 1972 to a new definition, average monthly production of oil subject to price controls in 1975. Producers could choose between taking the new level or retaining the old. At the same time FEA eliminated all existing "cumulative deficiencies."

The problem FEA intended to correct by this change was that the production level that was profitable at lower tier prices was moving further and further below the old BPCL, thus diminishing the profits to be obtained from additional production. The effect of moving the BPCL to equal the amount of oil being produced when the program went into effect is illustrated in Figure 14. In 1975 each producer who produced only old oil was setting this output at Q_1, the point at which marginal cost equalled the price at which old oil could be sold an average $5.03. Such producers would have faced a high base production control level, such as $BPCL_1$, based on production in 1972. By moving the base production control level down to Q_1, FEA insured that any producer who increased output above its 1975 level could sell the entire increment at upper tier prices.

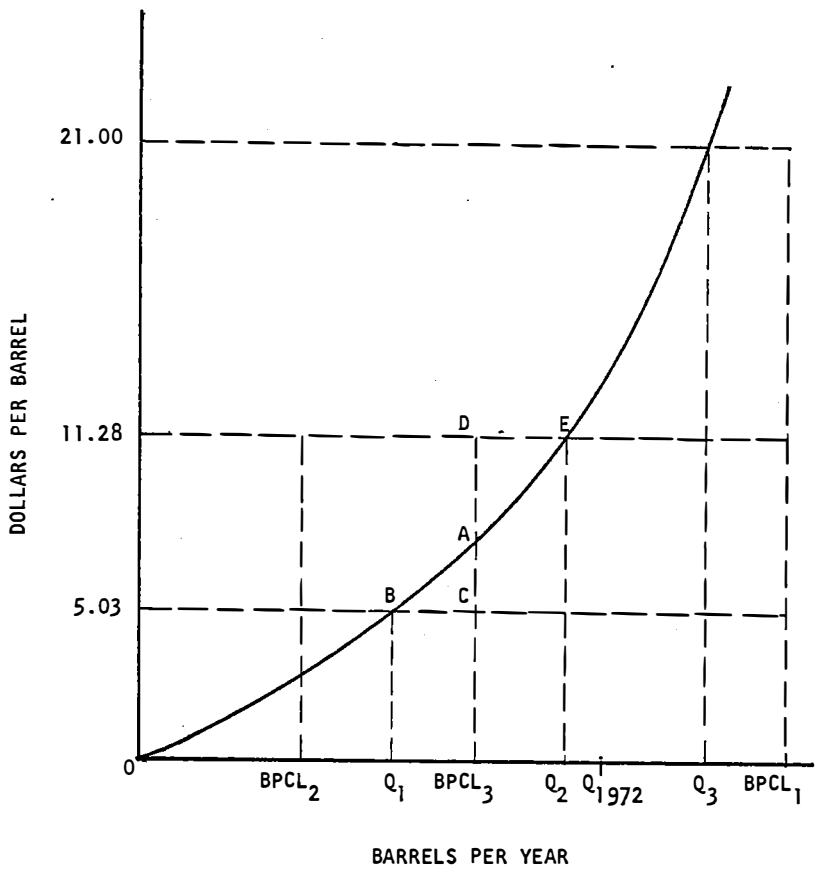
The situation was more complex for producers with new and released oil in 1975. Released oil is excluded from the "old" oil production rate in computing the BPCL. With released oil, marginal revenue equalled the world price of oil plus the difference between world and controlled prices, about $21, in December 1975. Some producers who had released oil under the old regulatory system would be assigned a BPCL (such as $BPCL_2$) lower than the amount of oil they would

be willing to produce at $5.00 per barrel. However, the extra revenue that results from this situation is not changed by output adjustments and does not affect revenue from increased production; consequently the efficiency of the production is undisturbed. Such producers would reduce output from Q_3 to Q_2, because without released oil the revenue that is derived from selling one additional barrel of oil is only $11.28.

Others could be given a base production control level higher than Q_1, the point at which additional output begins to cost more than the lower tier price, and below Q_2, the point at which additional output costs more than the upper tier price. In Figure 14, for example a producer with a 1972 production level of Q_{1972} might have chosen in 1975 to produce at the level Q_3, in response to the incentive of released oil. Then new oil production in 1975 would be Q_3-Q_{1972}. Since each barrel of new oil released one barrel of old oil from controls, an amount of oil equal to Q_3-Q_{1972} must be subtracted from the 1972 output level (Q_{1972}) to determine how much old oil was being produced in 1975. Figure 14 is drawn so that the difference between $BPCL_3$ and Q_{1972} equals the difference between Q_3 and Q_{1972}. Consequently $BPCL_3$, the amount of price controlled oil produced in 1975, is the base production control level assigned under current FEA regulations. That base production control level may be between Q_1 and Q_2,

Whereas under previous regulations, reducing output from Q_3 to Q_2 would have reduced revenues by $21 per barrel, it would reduce revenues by only $11.28 under the current system. Consequently it would be expected that all wells producing new and released oil would reduce output from Q_3 to Q_2, the point at which further reduction would

Figure 14
Effects of BPCL on Production Levels



reduce cost by less than the $11.28 per barrel revenue loss.

However, some producers could still find themselves in a situation like that described in the previous section, in which losses caused by selling some oil at lower tier prices exceed the profits that can be earned selling the remainder at upper tier prices. With released oil, the same producers could find themselves losing money unless production were allowed to fall back to low levels. If the area of the triangle ADE were less than the area of the triangle ABC, such a producer would contract to Q_1 because any higher output level, such as Q_2, would reduce profits. This result would be contrary to the intention of the regulations, which were designed to ensure that all domestic oil that could be brought out of the ground at a price of $11.28 or less should be produced.

Imported oil went into a third tier, because its price remained exempt from controls.

The initial stage of implementation of EPCA thus set the base production control level for each property at approximately the rate of production at which the per barrel cost of increasing output equalled the lower tier ceiling price. The second stage specified a schedule under which the price ceiling would be raised and the base production control level lowered.[107]

The adjustment in the base production control level is intended to prevent the increasing disincentive to production observed under the previous set of price controls, which specified a fixed base production control level. By eliminating this disincentive the adjustment eliminated the efficiency loss associated with price controls

on fields producing only old oil under EPAA.

The reduction in BPCL was applied initially only to properties that had produced no new oil since 1973.[108] FEA reserved judgement at that time on how to calculate special decline rates for properties "whose production levels during 1972-1975 reflected the effects of enhanced recovery programs."[109] Any property that was producing new oil between 1973 and 1976 would be granted a reduction in the BPCL only after its production remained below the initial fixed BPCL for six consecutive months.

The base production control level is reduced by means of an automatic, semi-annual adjustment based on "the actual, annual average production decline rate between 1972 and 1975 on a property-by-property basis."[110]

The gradual increase in the price of lower tier is based on authority which EPCA gave the FEA to increase the average of all domestic oil prices at an annual rate not to exceed the rate of an additional "incentive factor" of 3 percent. The combined incentive and inflation factors could not exceed 10 percent. FEA has decided to begin by dividing the allowable price increases equally between upper and lower tier oil. However, FEA determined that as lower tier oil was reclassified upper tier oil, through operation of the BPCL adjustment, it would eventually become impossible to continue to raise both price ceilings at a rate greater than the rate of inflation. That is, the entire 3 percent incentive factor would be used up by lower tier oil moved to the upper tier. (FEA estimates that lower tier oil will decline from its current 60 percent share of domestic production to 36 percent after three years.[111])

At the point at which applying allowable price increases equally would cause the upper tier price to use less rapidly than the rate of inflation, FEA will continue to increase the price of upper tier oil at the rate of inflation and will allow the price of lower tier oil to decline in real (but not nominal) dollars.[112]

Whereas the adjustment in the BPCL was intended to compensate for the effects of naturally declining production rates, the ceiling, price adjustment was intended to compensate for the effects of inflation on costs of production. Inflation could, by shifting the marginal cost curve up, have an effect similar and additional to the effect of reservoir decline. The two actions will roughly result in a situation in which any increment to production that can be obtained through investment in enhanced recovery will be sold at upper tier prices.

The schedule of price increases announced by FEA is presented in Table 8. That schedule was delayed because of errors FEA found in its initial computation of average prices.[113] It may be revised further because of price ceiling changes required by the Energy Conservation and Production Act of 1976 (ECPA).

That Act amended the EPCA to allow FEA to increase the average price of domestic oil by 10 percent per year, regardless of the rate of inflation. It also required FEA to use the increased pricing flexiblity for two purposes: to provide additional incentives to oil production using costly and exotic enhanced recovery methods ("tertary recovery") and to eliminate regional disparities in lower tier price ceilings. These adjustments would raise the prices at

Table 8

FEA's initial schedule of crude prices*

Month		Lower Tier May 15, 1973, posted price ($3.90)		Upper Tier Sept. 30, 1975, posted price ($12.60)	
February 1976	1.	PLUS: 1.35	($5.25)	MINUS: 1.32	($11.28)
	2.	1.38		1.25	
	3.	1.41		1.18	
	4.	1.45		1.11	
	5.	1.48		1.05	
	6.	1.51		.97	
	7.	1.54		.90	
	8.	1.58		.83	
	9.	1.61		.76	
	10.	1.64		.69	
	11.	1.68		.62	
	12.	1.71		.55	
February 1977	13.	1.74	($5.64)	.47	($12.13)
	14.	1.77		.41	
	15.	1.80		.34	
	16.	1.83		.28	
	17.	1.87		.21	
	18.	1.89		.15	
	19.	1.93		.08	
	20.	1.96		.01	
	21.	1.99		PLUS: .05	
	22.	2.02		.12	
	23.	2.05		.19	
	24.	2.08		.26	
February 1978	25.	2.12	($6.02)	.33	($12.83)
	26.	2.14		.38	
	27.	2.16		.43	
	28.	2.19		.48	
	29.	2.19		.55	
	30.	2.19		.62	
	31.	2.20		.70	
	32.	2.21		.77	
	33.	2.21		.84	
	34.	2.22		.92	
	35.	2.22		.99	
	36.	2.23		1.07	
February 1979	37.	2.23	($6.13)	1.14	($13.74)
	38.	2.25		1.22	
	39.	2.26		1.29	
	40.	2.26	($6.16)	1.35	($13.95)

(*Prices are based on the current rate of inflation, and will be revised at 6-month intervals to reflect changing inflation rates and congressional actions, including possibly an increase in the current 3% incentive rate.)

Source: Oil and Gas Journal, April 1976, p. 26.

which significant quantities of crude oil could be sold. According to FEA, those price increases would by themselves cause the average cost of domestic crude oil to rise above the level allowed by law. Consequently, the general ceiling price adjustments announced in April 1976 could be delayed even further.[114]

The delay in implementation of ceiling price increases due to FEA miscalculations moved the effective date to February 1977. Further delay due to the price revisions mandated by ECPA and to a change FEA made in the definition of "property" could delay the ceiling price increases to some time between May and October 1977. The more production responds to the ECPA incentive, the longer will be the required delay. FEA has indicated that a one-time adjustment of the composite price ceiling, which would require Congressional action, or a price rollback are alternatives to delayed implementation of ceiling price increases.[114a]

Even under the schedule of price increases announced in April 1976, crude oil price ceilings would not increase at a rate greater than the rate of inflation. Consequently, it is likely that when the 40 month control program mandated by the EPCA expires there will still be a substantial difference between domestic and imported oil prices. Few observers expect imported oil proces to increase at anything less than the rate of inflation. Consequently problems associated with precipitate decontrol, which arose when the EPAA expired and led to the passage of the EPCA, are likely to reappear when the EPCA expires.

The authority recently granted FEA to raise prices at 10 percent per year, regardless of inflation, would not resolve this

problem even if price increases began immediately and world oil prices increased at a rate of inflation well below seven percent. If the upper tier price were increased at a rate of seven precent per year, it would reach about $14 by the expiration of price controls. If imported oil prices rose at a rate greater than one percent, they would exceed $14 by that time.

ENTITLEMENTS

Under EPCA the entitlements system became more complex. Its goals remained those of ensuring that all refiners incurred the same average crude oil cost and that the cost of any incremental barrel equalled the nationwide average cost of crude oil. But under EPCA there were three rather than two tiers of crude oil prices; costs of lower tier, upper tier, and uncontrolled oil had to be made equal to the average cost of all crude oil. This equalization is accomplished by subdividing entitlements. Ignoring biases introduced by exception relief, small refiner bias, and import bias, the value of an entitlement is set equal to the difference between the average price of lower tier oil and the average price of uncontrolled imported oil. One full entitlement must be purchased to run a barrel of lower tier oil. Upper tier oil is fitted into the system by requiring that a fractional entitlement be held for each barrel of upper tier in the refinery input. The fraction of an entitlement required for each barrel of upper tier oil equals the ratio of the difference between the price of imports and the upper tier price to the difference between the price of imports and the lower tier price.[115]

The import bias was introduced "to preserve [the] incentives for refining domestic crude oil"[116] that were provided by the 21¢ oil import fee. It was introduced at the initiative of FEA, which set bias at a fixed 21 cents per barrel, and amended entitlement regulations to provide that "the entitlement price will be the exact differential between the weighted average costs to refiners of old oil and of imported crude oil less 21¢."[117]

The upper tier entitlement fraction was adjusted similarly. Its formula can be expressed as:

Upper tier entitlement fraction =

(average price of imports - average upper tier price - $.21)-

(average price of imports - average lower tier price - $.21)

= .178 in Apirl 1976.

With these rules an average barrel of lower tier oil cost the control price, $5.48 in April 1976, plus the value of one entitlement, $7.85 in that month, or $13.33 . An average barrel of upper tier cost the control price, $11.94, plus the cost of the required fraction of an entitlement, $1.40 or $13.34. A barrel of imported oil costs an average $13.55.[118] The difference between the post-entitlement cost of domestic oil and the cost of imports is the fixed 21 cent import bias in the entitlement system.

As in the entitlement system that existed under EPCA, every refiner receives a basic allocation of entitlements. The basic allocation reflects the national average proportions of lower tier, upper tier, and uncontrolled (imported and stripper) oil in refinery runs.[119]

Increasing refinery inputs by one barrel (of oil in any category) gives the refiner an additional fraction of an entitlement. The value of that fractional entitlement is sufficient to reduce the perceived cost of domestic oil to the average cost of crude oil, $10.50 in January 1976. The cost of incremental imported oil is 21¢ greater than the national average.

When EPCA regulations were formulated, Special Rule Number 6 was still in effect. That rule exempted small refiners from the obligation to purchase entitlements, on a sliding scale related to size. In May 1976 FEA replaced Special Rule 6, which provided large benefits to some small refiners and no benefits to others, with a more generous formulation of the basic small refiner bias.

Until this action, the basic bias provided small refiners with more entitlements than they would receive if their basic allocation were determined by the same rule applied to larger refiners. The number of additional entitlements granted was related to size. The bias gave small refiners a subsidy that rose from zero for a 175,000 barrel per day refiner to 2.4 cents per gallon for a refiner with 10,000 barrels per day capacity or less.

FEA rescinded Special Rule Number 6 on May 12, 1976, which increased the entitlements bias for all small refiners. The number of additional entitlements given refiners with capacity under 10,000 barrels per day was increased from 123.8 per 1000 barrels per day capacity to 222.8 per 1000 barrels. At the May 1976 price of entitlements that amounted to a 4.4¢ per gallon subsidy.[120] Larger refiners were granted smaller per gallon subsidies, on a schedule graphed in Figure 15.

A refiner with capacity of 100,000 barrels per day received a .24¢ per gallon subsidy, the same as it had received prior to May 12.[120a] The benefits of the increased small refiner bias went exclusively to refiners with capacities under 100,000 barrels per day.

FEA stated two reasons for increasing the small refiners bias:

> "... when the entitlements program was instituted in late 1974... FEA determined that [a bias equal to] the historical preference granted to small refiners under the oil import program as in effect in 1972 was sufficient to preserve the competitive viability of that class. However, over the first year that the program was in effect FEA received substantial evidence that the bias may not in fact be adequate for its intended purpose".

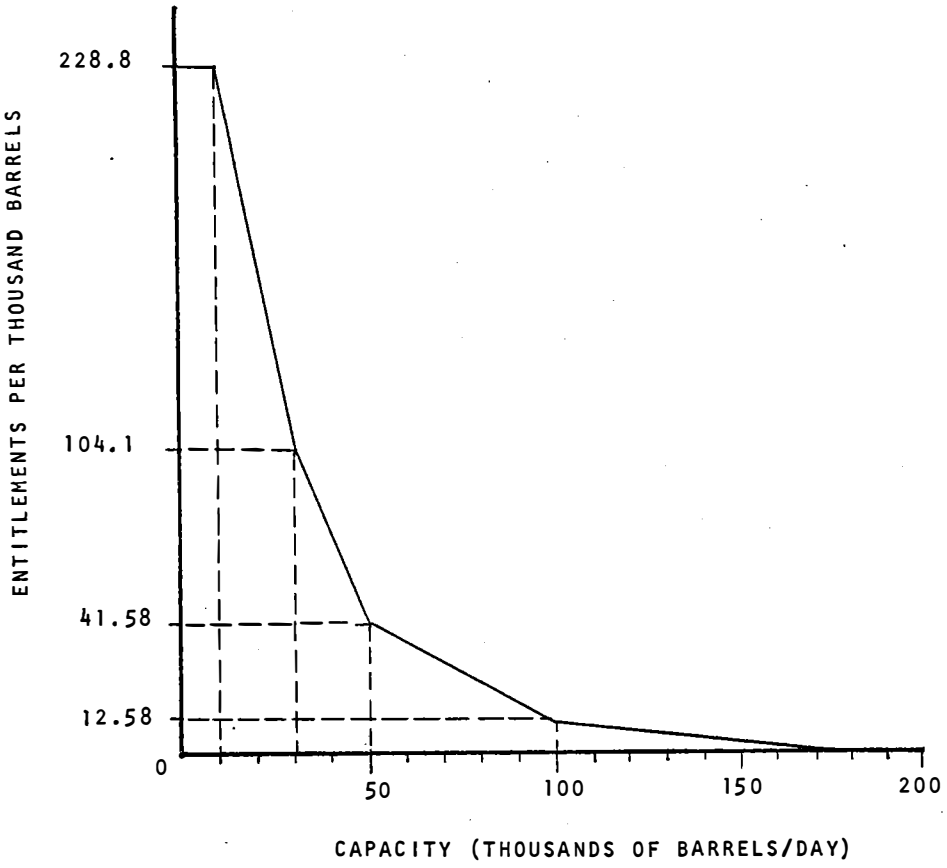
> "In addition, FEA is basing its determinations to increase the small refiner bias to a significant extent on the congressional concern for small refiners..."[120b]

Entitlements granted to each refiner are also adjusted in some cases to reflect imports of refined petroleum products and production of residual fuel oil (for refiners selling in the Northeastern States).[121]

PRODUCT PRICE CONTROLS

The EPCA required that refiners pass through their decreased crude oil costs (resulting from the price rollback) on a dollar for dollar basis and that they allocate the cost decreases proportionately to each product. A the time of passage of EPCA, FEA estimated that refiners had banked about $1.2 billion in banked costs. Subject to certain restrictions, they were allowed to retain those banks and apply them to reduce price rollbacks. Despite that provision, gasoline prices dropped over 1 cent per gallon in two months after rollback.[122]

Figure 15
Small Refiner Bias in Entitlements



Source: 41 Federal Register 20395

Such a fall is exactly what would be expected in a competitive oil industry with price controls at the crude oil level alone. If competition sets refined product prices on the basis of marginal costs, the fact that producers incurred costs in the past which were not covered by increased revenues is irrelevant to current pricing or production decisions. The drop in gasoline prices was less than the reduction in average crude oil costs that resulted from the rollbacks of upper tier prices. The difference may be explained by the increased demand for gasoline that would result from lower prices. With increased demand refiners can expand output somewhat, raising incremental refining costs and thus increasing the markup on crude oil costs that is required to cover refining costs. Such a development is normal in competitive markets, and would not imply that refiners were obtaining windfalls from reduced crude oil prices.

Early in 1976 FEA granted refiners substantially increased discretion in how they allocated increased costs among products, and broadened somewhat the definition of allowable costs.[123]

Decontrol Actions

During 1976 FEA has proposed, and Congress has approved, removal of price controls and mandatory allocation requirements on all major petroleum products except gasoline and jet fuel. The rationale for these decontrol actions was that product price ceilings were generally above the levels that prices would reach on free markets, and that removal of controls would make for more efficient and competitive markets.

The EPCA allowed FEA to propose elimination of mandatory

allocation and price controls on any category of refined products, subject to the condition that FEA must first make three findings:

- "...that such oil or refined product category is longer in short supply and that exempting such oil or refined product category would not have an adverse impact on the supply of any other oil or refined product..."
- "... that competition and market forces are adequate to protect consumers and that exempting such oil or refined product category will not result in inequitable prices for any class of users of such oil or product..."
- that exemption is "consistent with the objectives" of the EPAA.

In addition any proposed exemption must be accompanied by "a statement of the President's views as to the potential imports (if any) of such (exemption) amendment..."[124]

In March 1976 FEA proposed elimination of mandatory allocation and price controls on residual fuel oil, used as boiler fuel by electric utilities, industry, and large residential complexes. The FEA based its proposal on four findings:

1) Residual fuel oil is not in short supply, in that adequate refining capacity exists, to satisfy U.S. demand in conjunction with available imports.
2) Exemption of residual fuel oil would not have an adverse impact on the supply of any other oil or refined products.
3) Competition and market forces are adequate to protect consumers.

4) Exemption of residual fuel oil would not result in inequitable prices for any class of ... product user.[125]

The FEA analysis relied heavily on the existence of banked costs to establish that residual fuel oil prices would not rise if controls were removed. The analysis of price ceilings on refiners in Section III of the study and the drop in gasoline prices after crude oil prices fell despite cost banks support the conclusion that when banked costs exist, decontrol of product prices would either leave unchanged or reduce market prices. The price reduction can occur if refiners are subject to different ceilings. If the marginal supplier in such a market is selling at a market determined price, lower than its price ceiling, and others are selling at lower effective ceiling prices, low cost production from previously controlled refiners can substitute for the high cost production of the marginal supplier.

FEA supplemented this argument with a discussion of the residual fuel oil market shares of major and independent refiners, which they believed showed the competitive nature of that market. FEA concluded that "the relative market share of major refiners has declined considerably during the period 1972-1975 while large independent and small refiners have had a corresponding increase."[126] In 1975 major refiners had a 36.4% market share and nonmajors 36.1%. In addition, in 1975 non-refiner marketers controlled 27.5% of the market. According to FEA, nonmajor refiners and independent marketers "have a record of price competitiveness."[127]

About 60 percent of the residual fuel oil consumed in the Northeastern United States is imported from Carribbean refiners.[128]

In those states the price of domesticly refined residual fuel oil was about equal to the price of imported residual. FEA argued that under these conditions further increases in the price of residual fuel oil were unlikely to result from decontrol, because domestic prices could not exceed the price of imports and the price of imports was unlikely to rise because of decontrol.[128a]

At the same time it proposed decontrol of residual fuel oil, FEA altered the entitlement program for East Coast imports of residual fuel oil. It granted importers (refiner and non-refiner) of residual fuel oil three-tenths of an entitlement for each barrel of residual imported into the northeastern states. FEA also penalized domestic refiners one-half an entitlement for each barrel of residual fuel oil refined domestically and sold in the Northeastern states. The first 5000 barrels of such residual production by any refiner was exempted from this reduction in entitlements.

The purpose of these adjustments was to remove an anomaly that had existed in the east coast market without increasing the price of residual oil in that or any other region. Prior to the change, a Virgin Islands refinery owned by Amerada Hess had enjoyed a significant cost advantage over other importers. Despite its offshore location, the Hess refinery was considered domestic and received entitlement benefits for all the foreign crude oil it refined. Competing importers were at a substantial cost disadvantage, and lost significant market shares to Hess.

The adjustments reduced the cost advantage which domestic refiners enjoyed over foreign refiners to $.60 per barrel. FEA claimed

that this advantage would place product importers "under substantial market pressure to passthrough the maximum amount of entitlement benefits received whether or not price controls remain in effect."[129]

FEA concluded that the changes should "effectively prevent any price increases in the East Coast residual fuel oil market. ...[E]ntitlement benefits that would otherwise have been available for domestic residual fuel oil produced or sold in the East Coast will be reduced 50%, subject to the first 5000 B/D exemption. The amount of this reduction is expected to be approximately equal to the amount of entitlement benefits that will be provided to imports of residual fuel oil."[130]

Congress approved the proposed decontrol when the House narrowly failed to pass a resolution of disapproval.

On June 16, 1976, FEA proposed removal of mandatory allocation and price controls from middle distillates -- including home heating oils, diesel fuel, and kerosene. The proposal was accompanied by the same statutorily required findings that were made in the case of residual fuel oil. Again, FEA based those findings on the argument that no price increases would result from decontrol -- because existing price ceilings exceeded market levels -- and that the "market share of large, integrated refiners has been decreasing since 1972, while that of the large independent and small refiners has been increasing."[131]

FEA did , however, express the intention of taking corrective action if distillate prices rose by 2 cents per gallon more than would be predicted if controls remained in effect.[132] Essentially, that caveat meant that FEA would act if prices rose above the level to be

expected in a long-run competitive equilibrium. Some Congressional leaders argued, opposing decontrol of distillate, that distillate prices would increase to the level of imported products.[133] Oil industry spokemen, on the other hand, argued that the 2 cents per gallon increase above a base projection and the projection itself were so low that reimposition of controls could occur even if competitive pricing policies were followed.[134]

Imported distillates run under 5% of U.S. output of distillate as compared to the 60 percent characteristic of residual fuel oil.[134a] Adequate refining capacity exists that 100% of residual fuel requirements could be satisfied from domestic refineries, probably at a cost per additional barrel little above the current price. Because U.S. refineries have lower crude oil costs than foreign refineries (because of domestic price controls), only substantial inefficiency in U.S. refineries (compared to foreign operations) would prevent the U.S. refineries from eliminating imports before domestic prices rose to the price of imports. Consequently, except in areas where transport cost give imported distillate a clear advantage over U.S. competition, domestic distillate prices are likely to be independent of the price of imports.

Gasoline and some jet fuel prices remained controlled, and as of December 1976 FEA had not formally proposed removal of price controls and mandatory allocations. Substantial cost banks for gasoline do exist: they have, however, declined from a high of $485 million in April 1975 to $242 million in January 1976. (January 1975 banks were $431 million).[135] The crucial technical and political

question regarding gasoline price control is likely to be the trend in market shares of independent refiners and marketers.

The share of non-branded independents -- service stations not selling under a brand name belonging to a refiner nor affiliated with a refiner -- rose from an October 1974 level of 7.4% to a May 1976 level of 11.5%. However, since 1972 the market share of "branded independent service stations" -- those selling under a major brand name but owned or leased by its operator -- has declined steadily Between October 1974 and May 1976 branded independents share fell from 79.3% to 71.7%. Sales from gasoline stations owned by refiners increased from 13.3% to 16.8% of gasoline sales during the same period.[136]

On November 16, 1976 FEA issued its "Preliminary Findings and Views Conceiving the Exemption of Motor Gasoline" and expressed an intention of proposing exemption when the 95th Congress convened. The preliminary report details the following findings:

- that supply and demand for motor gasoline are in balance, and adequate refining capacity exists to keep prices from rising save to reflect increased crude oil costs.
- that there is sufficient competition in refining distribution and marketing to protect consumers.
- that exemption would not result in inequitable prices to any user because no price increase is projected to occur as a result of exemption.

The report also provided more current information on market shares. Table 9 reveals a small but steady increase in the market shares of large independent and small refiners, and a similar small

Table 9

REFINER SHARES (PERCENT) OF TOTAL MOTOR GASOLINE SALES

Quarter	Large Integrated Refiners	Large Indopendant Refiners	Small Refiners	Total Motor Gasoline Sale (Millions of Gallons)
1972				
Jan-Mar	74.1	0.4	17.5	23,139
Apr-Juno	74.0	8.0	18.0	25,626
July-Sept	73.6	8.2	18.2	26,493
Oct-Dec	72.8	8.4	18.8	25,324
ANNUAL	73.5	8.3	18.2	100,581
1973				
Jan-Mar	72.8	8.5	18.7	24,546
Apr-June	75.0	7.6	17.4	26,698
July-Sept	75.0	7.5	17.5	27,606
Oct-Dec	73.2	7.8	19.0	25,972
ANNUAL	74.1	7.8	18.1	104,822
1974				
Jan-Mar	72.8	8.0	19.2	22,935
Apr-June	73.6	7.7	18.7	26,277
July-Sept	74.4	6.9	18.7	27,291
Oct-Dec	72.6	7.6	19.8	26,370
ANNUAL	73.3	7.6	19.1	102,873
1975				
Jan-Mar	71.6	8.4	20.0	24,158
Apr-June	72.0	7.8	20.2	27,315
July-Sept	73.0	7.3	19.7	27,870
Oct-Dec	71.6	8.0	20.4	26,914
ANNUAL	72.0	7.9	20.1	106,256
1976				
Jan-Mar	71.1	8.6	20.3	25,407
Apr-June	71.2	7.9	20.9	28,670

Source: FEA Refiner Survey (FEA P-305-S-0 and P-306-M-0).

Source: FEA "Preliminary Findings Views" Exemption of Motor Gasoline"

decrease (1 percentage point per year) in the share of large integrated refiners. Table 10 reveals that in 1976 market shares of gasoline retailers appear to have stabilized, with refiner marketers maintaining a share a bit over 17 percent, non-branded independents a share just over 11 percent, and branded independents a share just under 72 percent.

FEA claims that

> These trends indicate the continuing viability of independent refiners and nonbranded independent marketers. The reduction of lessee dealer outlets is part of a general marketing trend away from low-volume sales outlets which tend to have higher average prices and is a consequence primarily of the combined forces of (1) a shift in consumer preferences to less service in return for lower price and (2) the general inflation in the costs of providing fuel service that raises the minimum gallonage required for a viable full service operation.[137]

FEA implicitly exculpates the price control and entitlements programs from responsibility for the higher prices charged by branded independents. This conclusion may be questioned, for reasons described in the next section. If the gasoline price control and allocation programs are responsible for the using share of independent, unbranded marketers, exemption could reverse that trend.

Table 10

U.S. MARKET SHARES OF GASOLINE SERVICE STATIONS

		Gallonage Sales by Type of Service Station			
		U.S. Total	Ref./ Mrktrs.	Non-branded Indepen.	Branded Indepen.
1974	October	100.0	13.3	7.4	79.3
	November	100.0	13.5	8.3	78.2
	December	100.0	14.0	9.0	76.9
1975	January	100.0	15.3	9.1	75.6
	February	100.0	14.5	9.6	75.9
	March	100.0	15.1	9.6	75.3
	April	100.0	14.6	10.2	75.2
	May	100.0	14.8	9.7	75.5
	June	100.0	14.8	9.7	75.5
	July	100.0	14.4	9.6	76.0
	August	100.0	14.9	10.2	74.9
	September	100.0	15.4	10.3	74.3
	October	100.0	15.4	10.7	73.9
	November	100.0	15.6	11.1	73.4
	December	100.0	17.2	11.1	71.7
1976	January	100.0	17.2	11.7	71.1
	February	100.0	17.2	11.3	71.5
	March	100.0	17.5	10.8	71.7
	April	100.0	17.0	11.0	72.0
	May	100.0	17.1	11.3	71.6
	June (P).	100.0	17.3	11.2	71.5

(P) Preliminary

Source: FEA. Petroleum Market Shares Report on Retail Gasoline Sales.

Source: FEA "Preliminary Findings and Views Exemption of Motor Gasoline "

V: EVALUATION OF CURRENT PROGRAM

CRUDE OIL PRICE CONTROLS

The new crude oil price regulations reduced the disincentive to increased production from existing properties that was created under the old, two tier system. Roughly, any increase in the output from an existing property above the production rate at which marginal cost equals the lower tier price can be sold at upper tier prices. The new regulations also removed the distortions created by released oil. However, the upper tier price at which incremental production and new oil must be sold is over $2.00 below the cost of imported oil. Consequently some domestic production that would cost less, per barrel, than imported oil is probably foregone.

Effects on Production from Existing Properties

The rollback of upper tier price is not likely to be a significant hindrance to maximum production from existing properties. Some of that production could come from enhanced recovery projects, which involve relatively large, discrete investments that will provide an acceptable rate of return at oil prices of either $11.28 or $13.50 per barrel. During 1975 FEA estimated that at least half of the oil that would be produced using enhanced recovery if prices were decontrolled would also be produced with $7.00 per barrel prices.[138] The exemption of tertiary recovery projects from controls is likely to allow most enhanced recovery projects profitable at uncontrolled prices to proceed. FEA estimates that the exemption will increase oil

production by 300,000 barrels in 1979.[139]

This conclusion would be reinforced if it were known that oil producers believed price controls would end after 40 months. The life of a new well or an enhanced recovery project is sufficiently long that revenues during the first 40 months are not crucial to the investment decision.

However, uncertainty about price controls can make delay in some enhanced recovery projects a wise strategy. In some cases a producer has two mutually exclusive alternatives: a low cost investment that would be optimal if price controls continue indefinitely, and a high-cost investment that would be justified by higher reputed prices if controls were to end in 40 months. Because of the penalties attached to guessing wrong on controls, producers may decide to wait, making no new investments until the future of controls is more clear.[140]

A schedule of price increases for domestic crude oil can also provide an incentive to delay investment in enhanced recovery projects.[141] If prices increase at a 10 percent annual rate, an oil producer can earn capital gains at a rate of 10 percent a year by leaving oil in the ground. Although generally not sufficient to justify shutting down wells, these expected price increases could tip the balance against some enhanced recovery projects that would be marginally profitable if begun immediately. With rising prices, it can be optimal to wait to begin an investment project until significantly after the date at which its present value first becomes positive.[142] That decision would not, however, reflect any social value of delaying increased production.

The price increases that result from redefinition of lower

tier oil as upper tier would not provide an incentive to delay implementation of an enhanced recovery project if the base production control level shifts planned by FEA worked in an ideal fashion. The BPCL for properties producing lower tier oil is intended to decline at a rate such that efforts to arrest the natural decrease in output from a property will be rewarded by permission to sell the additional output resulting from those efforts at upper tier prices.

In more technical terms, the intent of FEA was to shift the production control level to the left at the same rate as the marginal cost curve shifts (see Figure 8). In that case, net revenue from increased production will be the same, no matter when the increased rate of production is begun.

By applying the same decline rate to all fields, FEA failed to achieve this ideal system. But it is almost impossible to say what would have happened to production from a property if efforts to maintain production had not been made. Although the FEA system retains some disincentive to such efforts, since the BPCL adjustment will be inadequate for some properties, the uniform approach has merits on grounds of administrative feasibility.

On the other hand, expected increases in the price of upper tier oil greater than those required to cover inflation would create the incentive to delay investment. Under the current schedule, that incentive will not exist, but accelerating the pace of price increases to achieve parity between domestic and world prices in three years could provide a significant incentive.

There is some evidence that FEA's revisions of lower tier price controls did provide an incentive to increasing production from existing properties. In October 1976 the Oil and Gas Journal reported that activity directed at renovating and increasing production from existing fields had reached the highest level reported since 1973.[143]

Effects on Exploration and Development

Upper tier price controls are more likely to retard exploration and development of new oil properties than they are to deter investment in enhanced recovery. Until the change to the three tier price system, all production from a well drilled on a new property could be sold at uncontrolled prices. The new price regulations rolled that price back by over $2.00 ($1.35 plus the increase in the price of imports between September 1975 and January 1976).

It is clear that the price rollback cannot have encouraged additional exploration and development of new oil reserves, but it is difficult to quantify the resulting loss. The rollback may not be large enough to make more than a few projects that would be profitable at work prices unprofitable at controlled prices. Or, producers may expect the ceiling to end after three years and consequently give a little weight in projecting revenues over the life of a project. One piece of evidence regarding the effect of the rollback comes from examination of the number of drilling rigs in operation before and after it took place. The Hughes rig count is an accepted measure of activity directed at developing new supplies of oil. In December 1975 the rig count was 1973; in February 1976 it had fallen to 1594.[144]

That drop was widely intepreted as a sign of the effects of the price rollback, despite the fact that the rig count has been high in December and low in January every year since 1973.

The drop in the rig count between January and May 1976, on the other hand, is statistically significant. Drilling activity in those months is almost certainly below the growth trend established in 1973-1975. Total footage drilled in January through March 1975 is also significantly below the trend: the chances are about 92 out of a hundred that the drop is not due to chance. (see the Appendix for discussion of the statistical analysis). However, on this evidence alone it is impossible to assign responsibility for the drop to the rollback in upper tier prices, because it could also be due to the elimination of released oil.

If there was a substantial amount or redrilling of existing properties to obtain "released" oil -- and a marginal revenue on the order of $14 to $21 -- then drilling would be expected to drop off when released oil was eliminated. That reduction in activity would, on the argument in Section III, represent a new welfare increase, because of the economic inefficiency involved in expanding redrilling until production costs were well above the price of imports.

By October 1976 drilling activity had climbed back to a level higher than that achieved in October 1975.[145] Whether activity remains significantly below the level that would be expected based on past growth trends has not been determined. In any event, considerably more sophisticated analysis would be required to reach a more precise

and quantitative conclusion regarding the impact of controls on exploration. Whatever the impact, any decline in oil production that would result from a decline in exploration and development would not eventuate for several years.

The annual welfare loss that such a decline in production could cause can be bounded roughly by comparing projections of U.S. oil production in 1985 with and without price controls. With some crude interpolations, one can infer from FEA projections that maintaining a ceiling price of about $11.50 (in constant dollars) until 1985 would reduce U.S. oil production by about 1.1 million barrels per day in 1985.[146]

Since upper tier prices are about $2 per barrel less than current price of imports and production prevented by that price must cost somewhere between upper tier and import prices, a reasonable estimate of the cost of the 1.1 million barrels per day production is $12 per barrel, $1 less than the price of imports. If that production could be obtained at a price $1 less than the price of imports, the annual welfare loss would be about $400 million. The loss resulting from temporary price controls is likely to be smaller unless considerable reduction of investment in anticipation of rising prices occurs.

Price Differentials

Current price regulations governing crude oil also preserve price differentials in existence in 1973. Changing market conditions may make those differentials inappropriate. One example of such a situation is heavy California crude oil. That oil was subject through 1976 to a lower tier ceiling price of $4.21 per barrel, about $1 per barrel below

the lower tier ceiling for identical oil in other areas of the country.[147] On August 15, 1975 FEA refused to revise the California ceiling, on the grounds that "there was no evidence to support the conclusion that a special upward price adjustment for California would result in more increased production than would result if the same price adjustment were applied in other areas of the nation."[148] FEA was at that time authorized to revise ceilings only when so doing would contribute to increased oil production.

The ECPA, passed in August 1976, changed the situation, mandating a revision of California prices. An adjustment for California heavy oil has been proposed by FEA, but when this study was completed it had not been adopted. FEA predicted that such revision could increase California production by 40,000 barrels per day over two to three years.[148a]

Heavy California oil is particularly suited to refining into residual fuel oil. Currently, high prices of imported residual fuel are leading to a shift in domestic refining yield patterns toward production of residual fuel oil.[149] Consequently a shift toward increased production of heavy oils would appear justified in light of new market conditions. The existing lower tier ceiling on California oil prevents an effective signal being sent to California producers of the need for such a shift.

Some analysts, however, content that the lower price for California heavy oil is justified by local conditions. Demand for gasoline and low sulfur fuel oil is higher in California than in the rest of the country, due to air quality requirements, climatic conditions and driving patterns. California refineries are not equipped to process heavy, high sulfur oils into these products, and consequently demand

for heavy oil is weaker than in other parts of the nation. These circumstances could justify a regionally lower price.[150]

Effects on Demand

Welfare losses due to consumer response to average cost pricing of oil are an intrinsic part of effective crude oil price controls. Entitlements provide a subsidy to imports by causing refined product prices to reflect average crude oil costs even though oil must be imported to satisfy demand at those prices. The subsidy is an inevitable result of the decision to use domestic crude oil price controls to hold down prices facing consumers. Because of the subsidy, price controls result in an inefficiently high level of demand for imports. Consumers are offered petroleum products as if the marginal cost of production included crude oil inputs at $10 per barrel, whereas the true marginal cost curve is at least three dollars higher (for any demand levels that imply imports).

The difference between average refiner cost of crude oil, including domestic oil and imports, was about $3.00 during 1975.[151] In May 1976 the differential was also about $3.00, the rollback in domestic prices being roughly equalled by the removal of the tariff that existed during 1976). Between mid 1975 and mid 1976 the average refiner acquisition cost of all oil was about $10.50.

Consequently, decontrol of all oil would raise the cost of crude oil passed on to consumers by about 30 percent, as it would have in 1975. The welfare loss due to the increased consumption that results from holding prices below marginal cost would therefore be about the

same as it was estimated earlier -- something under $1.5 billion annually. Because of lags in the adjustment of production and demand to price, it would take several years after decontrol for this increase in welfare to appear.

Income Transfer

Under current conditions crude oil price controls also transfer to oil consumers over $15 billion per year of revenue that would go to domestic oil producers and owners of oil fields of all oil sold at world prices. In May 1976, refineries processed 140 million barrels of crude purchased at an average lower tier price of $5.50, and 110 million barrels of upper tier crude oil purchased at an average price of $12.50. If, instead, refineries had purchased these 250 million barrels at the average refiner's acquisition cost of imports, $13.50, they would have spent an additional $1,285 million in May.[152] Assuming that all these costs were passed through to consumers, and converting them to annual figures, the petroleum products would have cost about $15 billion more in 1976.

Price controls on upper tier oil alone are responsible, according to these figures, for an annual income transfer of $1,985 million.

PRODUCT PRICE CONTROLS AND MANDATORY ALLOCATION

Gasoline represents about one-half of the volumetric output of U.S. refineries. Continued price controls on gasoline mean both the refining and marketing sector are subject to significant, direct price

regulation by FEA. The basic analysis of refinery price controls presented in Section III remains relevant: those controls will create a situation in which gasoline is not refined at the least total cost across the nation, as long as some refiners are subject to effective price ceilings.

Moreover, the problem of allocating increased costs among petroleum products to retain appropriate price differentials remain, because FEA regulations issued subsequent to decontrol of residual oil and middle distillates specify that costs allocated to decontrolled products may not be used to raise the ceiling price on gasoline.[153]

These problems are exacerbated by the prevalence in petroleum refining of costs not directly connected to any particular product. Such costs cannot be allocated properly save by examining the characteristics of demand, a function performed by markets in the absence of price controls.

FEA entered an exceedingly murky area when it specified rules for allocating costs among products. Even within the oil industry and prior to the imposition of price controls, there was no agreement on the proper method of allocating costs among refined product categories.[154] In the long run, a decision to change a refinery's product mix may result in changed equipment and purchase of different types of crude oil. Changes in costs which result can provide some hints as to appropriate prices for different products. However, many costs are unaffected by change in product mix, especially in the short run. Under these conditions, economically efficient pricing of petroleum products requires that the response of demand to prices be taken into

account. Consequently no fixed allocation of costs among products can avoid losses in efficiency when demand characteristics are changing. FEA's rules for allocating cost increases among products may have been necessary to make auditing and enforcement of price controls feasible,[155] but unless they were ineffective it is very unlikely they resulted in relative prices of refined products that would encourage economically efficient resource allocation.

When all products were subject to price controls, FEA regulations gave refiners some discretion in allocating increased costs among refined products. Now that gasoline and jet fuel alone remain controlled, and FEA rules specify precisely how costs must be allocated, maintaining appropriate price differentials among products is nearly impossible.

Competition in Gasoline Retailing

Various features of the price control and allocation program combine with customary practices of the oil industry to reduce competition in the gasoline marketing sector. The absence of normal competitive markets is suggested by the substantially different prices charged by retail outlets of the same type in the same location. Some such differentials have always existed, because of brand identification, credit cards, and minor locational advantages. However, in the past price wars were also evidence of active competition among retail outlets; they have almost disappeared.

Effects on Refiners

Retailers purchase gasoline at different prices, depending on how their suppliers are affected by entitlements and product price controls. Without effective product price controls, inequalities in crude oil costs created by the entitlements program would not necessarily create unequal product prices. They would, however, give low cost refiners an opportunity to increase their market share if they could increase refinery output without increasing unit costs sufficiently to erase the crude oil cost advantage. To increase market share, low cost refiners and marketers purchasing gasoline from them might hold prices below the level that would give acceptable profits to high cost refiners and marketers.

If price controls were effective, they would force independent refiners and marketers to sell at lower prices than some major referers and branded retailers. The price differential could still drive some branded independent retailers out of business, thus increasing the market share of all other retailers including nonbranded independents. However, the effective price ceiling would prevent smaller refiners from increasing output, if unit costs are increased when output is increased. Consequently the decreasing share of branded independents would be more likely to result in an increasing share of retail outlets owned by the major refiners than in an increasing share of unbranded independents.

In different regions of the country both effects are likely to be observed. Some refiners have adequate cost banks (or initially high price ceilings) to be effectively uncontrolled; others may not.

Effects on Retailers

Because of the small refiner bias, the twenty or so large, integrated refiners face higher crude oil costs than do some smaller, independent refiners. The integrated refiners customarily control the flow of gasoline all the way down the distribution chain. Retailers selling under major brand names have, for the most part, signed contracts that prevent them from shopping around for low priced gasoline; they must take delivery of gasoline from distributors designated by the refiner. Consequently independent branded retailers obtain relatively little gasoline from refiners benefitting from the small refiner bias.

Independent unbranded marketers obtain gasoline supplies in equal proportion from small and independent refiners and from large integrated refiners. The small refiner bias may make gasoline produced by such refiners less expensive than gasoline produced by major refiners, although economies of scale in refining suggest that other things being equal, integrated refiners would have lower costs.

Independent unbranded retailers may also benefit from the purchaser-supplier freeze and the penalties which FEA imposes on changes in the price differentials between various classes of purchasers. Price control and allocation programs enabled purchasers in any category that obtained gasoline at discount prices from major refiners during 1972, base year of the purchaser-supplier freeze, to continue to obtain gasoline on relatively favorable terms. There do not appear to be any quantitative estimates of how this has changed the cost of gasoline to independent, unbranded marketers from what it would be absent the FEA regulatory program.

If major, integrated refiners charge branded independent dealers significantly more for gasoline than the price paid by unbranded dealers, branded independent dealers would be unable to lower their prices sufficiently to compete with unbranded dealers and still earn a profit. The natural result of this situation would be the persistence of price differentials and a declining market share of independent branded dealers.

Refiner owned and operated stations may be able to survive on lower profit margins than dealer-owned stations if refiners anticipate the end of the FEA regulatory program. The long run profitability of gasoline retailing might provide a corporation with large financial resources an acceptable return on investment, whereas an independent owner of a single station would be unable to survive several years of reduced income from his sole source of livelihood.

Price Competition

In addition to these effects of FEA regulations on gasoline price differentials, the requirement that refiners treat all purchasers in a certain group equally makes price wars very expensive. Price wars were in many instances the mechanism by which price differentials at the retail level were removed.

Product price regulations require that all purchasers in a given group be charged the same price for gasoline. Thus if a refiner offers one, or a few, retailers lower prices to assist them in a price war, it must lower prices for all purchasers in the same group with those retailers. Consequently the cost of supporting a price war

is much larger, if a refiner participates, under price controls than it was prior to price controls.

Finally, it must be emphasized that in a competitive industry the crude oil price control and allocation system would make product price controls unnecessary. Consumer product prices can be held down to any feasible level by the crude oil regulatory system. In this situation, effective price controls at refining and marketing levels can only serve to squeeze profit margins and, eventually, lead to inadequate refining capacity or a shrinking distribution system.

Like the entitlements system, product price controls may have a pervasive justification in terms of redistributive goals even if competition is not a problem. Product price controls coupled with crude oil price controls and the cost equalization (entitlements) program can only make consumers as a group worse off than they would be with the crude program alone. But by altering the relative prices of different petroleum products or the geographical pattern of such prices the product price controls would benefit some consumers at the expense of others. Programs with such a fine pattern of distributive effects may be very hard to dismantle.

PURCHASER-SUPPLIER FREEZE

The purchaser-supplier freeze is important in gasoline retailing because it allows some unbranded, independent retailers to continue to obtain gasoline from major refiners at advantageous prices prevailing in 1972. The freeze does not, however, tie end users to suppliers of gasoline. An automobile driver can buy gasoline from

whomever he or she pleases. That freedom appears to be turning customers away from full-service, branded gasoline stations. Those stations do not purchase high-priced gasoline from the major refiner under whose brand they sell because of the purchaser-supplier freeze. They do so because of their own pre-existing contracts with the refiner to purchase gasoline only through resellers designated by the refiner.

The crude oil purchaser-supplier freeze is still in effect. However, none of the three justifications offered at its inception retain their force. (See Section II). The end of the embargo and the institution of the entitlements system have removed all the problems which the freeze was designed to solve.

1) with adequate supplies of imported crude available and with entitlements to equalize its cost to that of controlled oil, the buy-sell list for which the freeze was a basis, is unnecessary
2) the end of the embargo suggests that changes in the crude oil distribution system would be reasonable responses to market changes
3) the entitlements system effectively removes any incentive to bid up the price of controlled oil.

These observations do require two qualifications. If, as the FTC staff has claimed, major oil companies have sufficient market power to refuse to deal with land-locked independent refineries (an action presumably illegal under the Sherman Act) or to deny them access to pipeline transportation, the purchaser-supplier freeze might

hinder such actions.[156]

SMALL REFINER BIAS

The entitlements system is a flexible tool which lends itself to efficient operation of such redistributive measures as the small refiner bias. But the entitlements system is closed: an advantage to one part of the industry is a disadvantage to another. The additional entitlements given small refiners were taken away from the larger refiners. The result was to give refiners with capacity under 10,000 barrels per day entitlements a cost advantage of about 4.4 cents per gallon. The advantage declines to zero as capacity increases to 175,000 barrels per day.

As a result of this subsidy, refiners less efficient than large independent or major integrated refiners are maintained in business. Keeping such refiners in business was stated explicitly as the purpose of the regulation. However, keeping inefficient refiners in business raises the ultimate cost of refined products above what it would be if small refineries were replaced by large refineries of equal total capacity. Only if the small refiners somehow create a competitive environment that would not exist without them can the bias be justified in terms of efficiency.

The subsidy does not, however, appear to have created any perceptible movement toward an increase in the number of small refineries. An FEA refinery survey dated July 1976 found only four new refineries with capacity less than 10,000 barrels per day completed since December 1975, and that only one such refinery was planned for

1977.[157] The small refineries in operation during 1975 were almost exactly the same as the small refineries in operation during 1973, according to the annual refining surveys reported in the Oil and Gas Journal.[158] There may, however, have been some cases in which a small refinery was "spun-off" by a large refiner so that it would receive the entitlements subsidy. While changing ownership patterns, such changes would not alter the efficiency of the refining industry.

COSTS OF PAPER WORK AND COMPLEXITY

To the efficiency costs of the direct economic effects of FEA regulations might be added the cost of running and complying with the FEA regulatory program. It is somewhat difficult to determine what fraction of FEA's budget could be eliminated if the entire system of oil price regulations were eliminated. In 1976 the Office of Regulatory Programs employed 1500 persons,[159] and had a budget of $30 million.[160] To that must be added some of the budget of other FEA divisions which also carry out or support regulatory activities, giving a conjecture of about $50 million as expenditure on regulation during 1977.

The reporting requirements of FEA regulations also require a substantial effort on the part of the petroleum industry. A tabulation by the General Accounting Office states that in fiscal year 1976 almost 8 million man-hours of effort were expended meeting FEA requirements. The FEA was second only to the Federal Communications Commission in the paperwork burden it imposed, according to this study.[161]

The complexity of the FEA regulatory program has probably caused substantial additional effort, to understand and apply regulations and to file requests for exceptions and appeals. Widespread industry misunderstanding of the rules for recouping non-product costs, which was revealed when FEA revised those rules, may be an example of one type of problem which FEA regulations have caused the industry. For two years refiners had been applying non-product costs to increase prices and banking some product costs. In 1976 FEA determined that such a procedure was contrary to regulations, even though many refiners had in apparent good faith interpreted the regulations as allowing the procedure. In November 1976 FEA was still wrestling with whether to require adjustment of the "overcharges" that resulted to grant a retroactive exception to all refiners, or to require each refiner to file separately for an exception.[162]

EXCEPTIONS FROM REGULATIONS

FEA has an exceptions process, administered by the Office of Exceptions and Appeals, to alleviate serious hardships, inequities and other problems created by oil price and allocation regulations. By modifying the effect of regulations from what would be inferred from the published regulations themselves, that Office may significantly affect petroleum markets.

Two patterns in granting exceptions have appeared. One is the clear requirement that a firm's viability be threatened before relief will be granted on the grounds of severe hardship. As of June 15, 1975, FEA had not granted exception relief based solely on

serious hardship to any firm that had not proved that its profits had fallen (or were projected to fall) by at least 48 percent.[163] One result of this pattern is that no major integrated company has received an exception based on serious hardship, for such firms have done well in profits.

The second pattern is the lack of any clear guidelines for determining that hardship has been caused by FEA regulations.[164] FEA's Office of Exceptions and Appeals appears to try to err in the direction of generosity whenever there is a question of whether FEA is responsible for hardship. Relief, on the other hand, is generally limited to just what is sufficient to keep a firm in business.

In addition to "serious hardship," exceptions may be granted on grounds of "gross inequity," "distortion of regulatory purpose," "third party impact," or "rational policy." These subjective determinations have no clear relations to economic efficiency. Exceptions based on serious hardship, on the other hand, do.

For example, an exemption may be granted from entitlement purchase requirements if a refiner can demonstrate that without relief he would be driven out of business. The more diligent and careful FEA is at ensuring that no refiner granted relief could remain in business without that relief, the more it interferes with the normal processes that make markets work efficiently.

With the entitlements bias and the crude oil buy-sell program small refiners have access to crude oil at a price lower than that paid by large refiners. A small refiner that cannot make a profit, in the long run, under such a system has failed a fundamental market test.

It may be at a disadvantageous location relative to crude supplies or markets, its refining facility may not be able to use the type of crude he has available efficiently, or any of a host of other factors may generate long-run unprofitability. A competitive market can achieve production at minimum cost precisely because such operations are driven out. An explicit policy of assigning some of the rents which normally accrue to oil resource owners to such operations to keep them in business raises refining cost.

This is not to say there should be no flexibility in price or allocation rules, because it may be necessary to alter those to compensate for problems caused by the regulatory system itself. A small refiner whose profit margin was squeezed because of inability to pass through certain non-product costs because of FEA regulations might be conducting an economically efficient operation. Exception relief in this case would contribute to maintaining the efficiency of the industry.

Exception relief under the purchaser-supplier relation can also be detrimental to the efficient performance of an industry. Economic theory claims that in order to achieve efficient allocation of resources each resource must be directed to its highest valued use the use in which it can obtain the highest payment. To the extent that exception relief is directed at rescuing failing enterprises rather than simulating the results of a free market, it violates this precept.

One type of relief is to release a purchaser from relation with a high-cost supplier and to assign the purchaser to a low-cost supplier. In terms of efficiency, the result can go either way.

Testimony by one independent distributor claimed that his supplier had been allowed to increase prices sufficiently that the distributor could not resell gasoline save at a loss, and that he could not obtain gasoline from the suppliers to his competitors.[164a] On superficial analysis, such a claim for relief would seem warranted on efficiency grounds.

A wholesaler facing changing market patterns, on the other hand, might not make a warranted claim. For example, closing of gasoline stations near the distributor and opening of stations further away might increase transportation costs. Even if passthrough of these costs were allowed, (for example, because of banked costs), the wholesaler might be unable to charge higher prices (new stations might be closer to the other sources of supply). To assign that wholesaler to a lower-cost supplier would maintain a business that no longer had a place in an efficient distribution system.

A slight variation on the example could turn the verdict around. Non-product costs incurred by a specific wholesaler may not be passed on -- only adjustments based on average costs throughout the wholesaling sector are allowed. If such a restriction were responsible for inability to charge high enough prices to cover costs, exception relief could contribute to maintaining an efficient distribution system.

Without more detailed research, it is impossible to assess the impact of Exceptions and Appeals, or of the product price and allocation system they modify, on economic efficiency. In principle, FEA could have hit exactly on the right decisions to create the most efficient industry. That result is very unlikely, because errors do not cancel out. Giving relief which maintains an inefficient operation

in one case while allowing an efficient operation to fail in another adds up to two decreases in efficiency. Every decision that decreases efficiency adds another small, deadweight loss.

EFFECTS OF PERMANENT CONTROLS

The system of crude oil price controls has been depicted throughout this report as a device for capturing a certain portion of the economic rent inhering in oil fields developed prior to the use in world oil prices. The small refiner bias transfers some of that rent to small refiners, who appear to be responding by adding high-cost refinery capacity. Exceptions and exemptions can also transfer rents to other parts of the industry. The fundamental purpose price controls, naturally, was to transfer those rents to consumers.

However, as the discussion of released oil, the small refiner bias, and exception relief revealed, FEA has used its control over the economic rents that would accrue to royalty owners and oil producers in the absence of controls in ways that have altered incentives in inefficient directions. The very effectiveness and flexibility of the regulatory system in capturing those rents increases the potential for economic distortion. The give and take of the regulatory process results in the redistribution of some of those rents within the oil industry. There is a danger that continuation of oil price regulations will lead to increased industry orientation toward manipulation of the regulatory process and lessened attention to the market economics of oil production. Thus far, specific regulatory distortions (beyond those created by basic effects of price controls on supply and demand) may have been small in magnitude, because of

the expected demise of price controls. An unambiguous decision to continue price controls would make investment in regulatory games much more worthwhile.

SUMMARY: CURRENT REGULATORY PROGRAMS

Again, a recapitulation of the description and evaluation of current FEA programs is in order.

When the Energy Policy and Conservation Act was passed attention had shifted from problems of a severe crude oil shortage to inflation of oil prices caused by rising prices of imports and the macroeconomic shock that could result from instant decontrol. Between January 1974 and January 1976 the price of uncontrolled oil rose from $9.82 to $12.99 per barrel; the domestic average price in January 1976 was $8.63 per barrel.

The primary goals of petroleum price control and allocation programs, stated in the laws that authorized the programs, were three: to hold down the cost of gasoline, home heating oil, and other petroleum products to the nation's consumers; to prevent the macroeconomic shock that could result from another precipitate rise in energy prices like that experienced in early 1974; and to protect the independent sector of the petroleum industry. FEA's programs are also intended to achieve these primary goals, which are stated explicitly in the law (the Energy Policy and Conservation Act of 1975) authorizing the program, with the least possible loss in economic efficiency. However, given the goals and the intention to achieve them through price controls, some loss in economic efficiency is inescapable.

The EPCA required FEA to set prices for domestic crude oil at levels that would result in an average price of $7.66 per barrel. This required a rollback of prices in existence at the time of passage of EPCA. To achieve that rollback with minimum reduction in the incentive to produce more oil, FEA established a three tier price system.

Imported oil and oil from domestic wells with a maximum production of 10 barrels per day or less is not subject to price controls. As of 1976, such oil was being purchased by refiners at an average price of $13.27 per barrel.

"Upper tier" oil comprises any oil produced on a particular property in excess of the amount being produced during 1975, plus the quantity of domestic oil produced in 1975 and not then subject to price controls. Upper tier oil was initially controlled at an average price of $11.29.

"Lower tier" oil is all other domestic oil, roughly equal to oil produced in quantities less than the amount of "old" oil produced in 1975. "Lower tier" oil was initially controlled at an average price of $5 per barrel, the same price ceiling that has been in effect since December 1973.

The classification of oil into lower and upper tiers was designed to create the largest stimulus to increased production from existing properties consistent with Congressionally mandated average prices. Because of the altered definition of old oil, any producer who can increase production on a given property above 1975 rates can sell the incremental output at upper tier prices. Consequently the lower tier price is not a significant hindrance to increased production of

reasonably priced energy.

Upper tier prices are, however, less than world market prices (by about $2). Thus producers are not encouraged to supply all oil that can be produced at a cost less than the cost of imports.

The EPCA, as amended in August 1976, allows FEA to increase the average of all domestic oil prices at an annual rate not to exceed 10 percent. FEA has decided to increase the average price in two ways. First, some lower tier oil will be redefined every six months as upper tier oil, and thus qualify for higher prices. Second, lower and upper tier price ceilings will both be raised. The first priority in adjusting ceilings is to ensure that upper tier prices increases keep pace with the rate of inflation.

The rationale for this program is maintenance of the incentive to increase production from existing fields. As fields age and with inflation, it becomes more expensive to maintain their rate of production. The increased price and gradual reclassification of lower tier oil is designed to maintain incentives at their initial level despite progressively increasing cost of production.

However, by 1979 about 36 percent of domestic oil production will still be subject to a price ceiling of about $6.00; the remainder will be controlled at about $14, less than the expected level of world oil prices. Thus expiration of price controls would cause an abrupt increase in domestic prices. To decontrol oil prices more quickly would require affirmative action by Congress.

If all controls on oil prices were removed in 1976, that action would transfer about $15 billion annually from energy consumers

to owners of oil properties. Increasing upper tier prices to market levels would, on the other hand, provide the same increase in production at a cost of about $2 billion annually. Increasing lower tier prices to upper tier levels would not, given FEA's current regulations, significantly increase energy production. The welfare loss imposed by the constraint upper tier prices place on increased production is probably something under $400 million.

The welfare loss resulting from the subsidy to imports, which still exists under the current price control and entitlements system, is about what it was under the previous system, $1 billion per year.

The EPCA extended the life of all produce price control and allocation programs that existed before its passage. It did, however, provide a mechanism for dismantling those programs.

One effect of product pricing regulations is to create unequal prices for the same refined product; those price differentials may not be competed away because of restrictions which the purchaser-supplier freeze puts on shopping around. Such price inequality is a source of economic inefficiency, the magnitude of which cannot be qualified at the time. Maintenance of historical price differentials between types of product probably creates similar inefficiencies, because demand conditions have changed since the base period of 1973.

During 1976 FEA has proposed, and Congress has approved, removal of price controls and mandatory allocation requirements on all major petroleum products except gasoline. The rationale for these decontrol actions was that product price ceilings were generally above the levels that prices would reach on free markets. Because of crude

oil price controls and the cost equalization program, consumer costs should in principle be held down without direct controls on any downstream prices. That conclusion is supported by the absence of significant price increases during the few months since decontrol of residual and distillate fuels. Decontrol of gasoline prices will require FEA initiative and Congressional approval.

The decision about decontrol of gasoline rests on beliefs about the degree of competition in the oil industry. If the industry is competitive, decontrol of gasoline prices would have no harmful effects on the economic performance of the industry, though specific individuals (particularly inefficient retailers) might be harmed.

Since 1974 there has been a significant increase in market shares of independent, unbranded retailing and of refiner owned retail outlets. That increase is at the expense of the share of independent operators of branded stations.

The decrease in the market share of branded independent gasoline retailers has probably been due in part to the cost advantages which unbranded marketers obtain from the controls on prices charged them by large integrated refiners and the entitlements subsidy to small refiners -- which sell mainly to unbranded dealers. How much of the cost advantage will disappear if price controls on gasoline are eliminated depends on which factor dominates. If, as FEA claims, the small refiner bias does nothing more than compensate for the higher costs which small refiners incur because they do not enjoy the economics of scale that attend operation of a large refinery, then the entire cost advantage would be due to the class of purchaser rule under price

controls. In this situation, removal of price controls on gasoline could be expected to alter the structure of gasoline marketing. If, on the other hand, the small refiner bias is responsible for the cost advantage of nonbranded independents, only a revision of the entitlements program would change the structure.

If, as FEA has claimed recently, general inflation and changing consumer tastes are responsible for the decline of the branded independent, the current regulatory program is irrelevant to the situation.

A pervasive problem arises from FEA's granting exceptions from its regulations. The Office of Exceptions and Appeals tends to err on the side of keeping firms in business. Because FEA controls the flow of rents (profits above those necessary to allocate resources properly), it has great power to keep unprofitable or inefficient firms from going out of business. Such actions tend to raise the cost of energy to consumers.

The crude oil price control and entitlements programs developed by FEA were creative responses to legislative requirements and were effective in carrying out the intent of legislation. There is little FEA could have done, in developing these programs, that would have reduced the economic inefficiency or distortions resulting from the basic price controls mandated by legislation.

In part, this success is due to the intended temporary nature of controls. The oil industry has not made major investment decisions in response to regulations because, up to now, it has expected regulations to expire in a few years. A clear intention to continue

controls could increase the expected payoff from manipulation of regulations, and would make FEA's task much harder.

The same evaluation cannot be made in regard to refined product price control and allocation regulations. Although the detailed studies that would ascertain their impacts were not available when this report was written, the tendency of those programs to interfere in the efficient operation of product markets was clear. Without providing any aggregate benefit to consumers of petroleum products, the refined product programs created individually minor but pervasive deviations from the conditions required for efficient allocation of resources.

VI: ALTERNATIVES TO OIL PRICE CONTROLS

Three goals for alternatives to oil price controls can be identified from the lesiglative history of price controls: equity, in the form of low energy prices to consumers; prevention of macroeconomic shocks; and protection of the independent sector of the oil industry.

Only the third of these goals can be seen as deriving even in part from an intent to improve the economic efficiency of oil markets, and the third is ambiguous. Preservation of the independent sector may be seen by some as a palliative to the market power of major, integrated oil companies. But for some policy makers, special treatment of the independent sector could be motivated solely by a desire to distribute some benefits to that sector, without regard for its efficiency of operation or for the market source of major oil companies. On this interpretation preservation of independents would not be directed at the goal of efficient allocation of economic resources.

The first goal, of holding down consumer costs, is clearly redistributive. Macroeconomic policy, evidenced in the second goal, is also normally discussed in terms other than economic efficiency.

In all the legislation establishing price controls, however, the President was directed to establish regulations that would accomplish the stated objectives with the least possible harm to economic efficiency.[165]

Except for possible questions about monopoly power and the effects of tax preferences, there is little doubt that in normal conditions economic efficiency in oil production would be greatest with

an oil industry untrammeled by price controls. Thus one method of constructing oil policy would be to leave investment, production and consumption decisions undisturbed while using the transfer of infra-marginal rents to achieve policy goals. With this idea as a key, several alternatives can be constituted.

The three tier system adopted by FEA holds down prices at the expense of a loss in efficiency and increased import dependence. Unless administrative outlays and the complexity of pricing regulations were increased substantially, that conflict appears inescapable.

MAINTAIN CRUDE OIL PRICE CONTROLS

Two alterations in the current regulatory program of FEA would considerably reduce losses in economic efficiency. If the upper tier price ceiling were removed, so that all production in excess of the declining base production control level could be sold at market prices, crude oil price controls would be nearly neutral in their effects on crude oil investment and production decisions.

Such a system would not be able to achieve the composite domestic oil price mandated in the EPCA. If the law were changed to make exemption of all upper tier oil from price controls possible, consumer expenditures on petroleum products would rise by about $2 billion per year. The efficiency loss from upper tier price controls, however, may well be on the order of $400 million per year.

Conceivably, a three or more tier price system could achieve the composite price goals of the EPCA without sacrifice of efficiency. Such a system would allow all newly discovered oil and some oil from

existing properties now in the upper tier to be sold at market prices, while continuing price controls at a lower level than the current upper tier ceiling on other oil production. It would be necessary to choose for such controls properties on which production in response to, say, $10 prices would equal production at market prices. Unfortunately, such a system would require detailed information about expected production rates and costs for every property in the United States. No feasible system of controls is likely to be superior to a two-tier system such as that just described in terms of economic efficiency and consumer cost.

If the entitlements program were retained, price controls on lower tier oil alone would hold consumer expenditures down by about $13 billion initially. As lower tier oil is reclassified due to the declining base production control level, that saving will decline. As long as it exists, price controls will represent a subsidy that increases oil consumption and imports.

To achieve reductions in consumption the plan of EPCA could be followed: mandatory and voluntary conservation program could substitute for rising prices to reduce oil consumption. However, such programs are likely to reduce the efficiency of resource allocation unless carefully designed.

A second alteration of the regulatory program is the elimination of remaining allocation programs and refined product price controls. As has been mentioned frequently in this report, those controls confer no benefits on consumers in the aggregate. With a competitive industry, adoption of any alternative to oil price controls would make

product price controls no more necessary than they are under the current system. Antitrust policy could be an alternative to those controls if the refining and marketing sector of the oil industry is not competitive.

That action could be purused either through the Justic Department[166] or through legislation aimed at reducing the market power of major oil companies. An example of the latter is divestiture legislation currently being considered by Congress.

ACCELERATED REMOVAL OF PRICE CONTROLS

If the efficiency loss associated with the first alternative makes continuation of the current program of price controls unacceptable, an alternative could be accelerating the rate of decontrol or allowing controls to lapse suddenly when the mandatory price controls program created by EPCA expires in May 1979. That alternative performs poorly both in terms of macroeconomic consequences and in terms of consumer cost. By May 1979, the current schedule of ceiling price increases would leave those ceilings considerably below projected market prices that would prevail absent controls. If the price of imported oil increases at only 5 percent annually, it would reach $15.40 per barrel by May 1979. By that date, scheduled increases would take lower and upper tier prices to only $6.16 and $13.95 respectively. Consequently, decontrol by May 1979 would transfer about $14 billion in constant dollar annual purchasing power from consumers to energy producers (See Table 11).

Table 11
Transfer in May, 1979

	Controlled Price	Quantity	Cost at Controlled Price (million $)	Cost at World Price
Old Oil	$ 6.16	122 million barrels	752	1879
New Oil	$13.95	132 million barrels	1841	2033

World Price at 5% escalation per year

$15.40

Transfer: $1318.8 per month

$15825 per year in 1979 dollars

$13671 in constant dollars

If decontrol were to occur suddenly in May 1979, the shock to the economy resulting from that drop in purchasing power would be smaller than but still comparable to that anticipated when EPCA was passed. In late 1975 CBO estimated the drop in purchasing power at $16 billion. An explicit rationale for passage of EPCA was that shock at that time would have unacceptable consequences.

In 1979 the economy is likely to be much more healthy than in 1975, so that monetary and fiscal policy measures could compensate for the shock of decontrol. Assuming that the shock in 1979 would be the same as projected in December 1975, an idea of appropriate fiscal and monetary policy for 1979 can be inferred from analyses of decontrol in 1975.

One investigation of combined fiscal and monetary offsets assumed that the Federal Reserve system would be willing -- contrary to its policy when prices rose in 1973 and 1974 -- to supply enough money to prevent a rise in interest rates. Then the loss in purchasing power from increased oil prices would be offset if in the first quarter after decontrol a reduction in withholding rates reduced tax collections by $10 - 13 billion and if further tax cuts of $6 to $9 billion occurred in the following three quarters. Government expenditures would have to remain at the same level that they would reach if controls were continued.[167]

Adjusting macroeconomic policy to accommodate the impacts of decontrol would be considerably easier if prices rose gradually to equality with import prices by May 1979. That approach to decontrol in May 1979 can achieve efficiency goals without macroeconomic disruption

-- if appropriate monetary and fiscal policy is adopted. However, that decontrol would cost consumers about $13 billion in increased energy costs in 1979.

EXCISE TAXES ON CRUDE OIL

A third alternative would use taxes to reduce the revenues of oil producers and royalty owners by the same amount as do current price controls. Those tax revenues would make possible the reduction of other taxes affecting consumers to restore the purchasing power lost to price increases. Such a system could perform as well as current price controls in terms of consumer benefits and macroeconomic policy, but with less damage to economic efficiency.

Excise taxes on crude oil could be designed to replicate current price controls if definitions of lower tier and upper tier oil were retained. An excise tax on lower tier oil could be declared to equal the difference between the May 15, 1973 price of that oil and the current landed cost of imported oil. The tax on upper tier oil could be set equal to $1.35 plus the difference between the current price of imported oil and the price of upper tier oil on February 1, 1976. All oil not now subject to control would be exempt from the tax.

To preserve the current cost advantage of domestic over imported oil, upper and lower tier taxes could be reduced by $.21.

With this tax system, all crude oil would sell at a price determined by the price of imported oil. Entitlements would not be required to equalize crude oil cost. However, the revenue from selling a barrel of oil a producer retained after taxes would be the same as the current ceiling

price on lower and upper tier oil (plus 21¢ if the import bias were retained).[168] The revenue from this excise tax could be returned to consumers through tax reductions (or prevention of tax increases) aimed at whatever groups are specified in the redistributive goals of Congress.

Since consumers would face product prices based on the true marginal cost of oil, the welfare loss due to increased demand that exists under the current system would be eliminated and imports of crude oil would be reduced. Welfare loss from lost domestic production would remain. It could be reduced by a schedule of excise tax reductions identical to the schedule of price increases now in effect, or special exemptions for high cost production. If the excise tax were phased properly with reduction in other taxes, no macroeconomic effects should result. Briefly, it should be mentioned that this tax differs in principle from the "windfall profits" taxes on oil producers much discussed in 1975. Those taxes were commonly designed as a percentage of the increased income of energy producers over some baseline. That provision does not discriminate as does the excise tax between increased profits on existing production where the tax cannot affect investment decisions and profits obtained through new investment where it can. Consequently it would have an adverse effect on production decisions.

Second, windfall tax proposals often contained plowback provisions, forgiving some portion of the tax in proportion to new investment in oil (or other energy) production. The plowback introduces new sources of economic inefficiency, including an incentive to produce from uneconomic properties and an incentive use production techniques that are excessively capital-intensive. Like the released oil provision

that existed before January 1976, it could be defended on grounds that oil imports must be reduced.

The excise tax has several virtues beyond its removal of the subsidy to imports (and excessive demand) without macroeconomic shock or reduction in consumer purchasing power. It could be implemented on the basis of data currently collected and compiled by FEA, since it works similarly to price controls.

It would also make possible the elimination of the crude oil entitlements system since all refiners would pay the same market price for crude oil. Elimination of entitlements would remove the discretion to redistribute rents within the oil industry which oil price regulators currently enjoy. Claims for special tax treatment would probably take the place of applications for exceptions from price controls, but -- in a cynical view -- this may be less noticeable because of the long history of tax preference for oil producers.

Dismantling the entitlements system would, however, remove the subsidy to small and independent refiners provided historically by the oil import program and currently by the "small refiner bias" in the entitlements system. If that bias is purely redistributive, it can be removed without deleterious effects on economic efficiency though at some cost to the market share of independent refiners.

If the subsidy through entitlements is viewed as an antitrust measure, its removal could result in a less competitive and atomistic petroleum industry, particularly if the lower gasoline prices charged by independent refiners are a factor in maintaining the market share of

independent, unbranded gasoline retailers. The alternative to using such a subsidy to preserve competition is antitrust action, through new or existing legislation.

APPENDIX

Statistical Analysis of Drilling Activity[169]

Both the Hughes rig count and the American Petroleum Institute's report of total footage drilled show a clear growth trend through 1975, and appear to drop off after January 1976.[170] A simple regression model and statistical test were used to see if the 1976 dates were significantly below the trend line inferred from earlier increases in activity.

In both cases, the index of well-drilling activity was regressed against time. No attempt was made to develop a comprehensive explanatory model of exploratory and development activity. However, dummy variables for December and January were introduced because of an obvious peak in December activity and trough in January. The year-end effects probably arise from attempts to complete activity during the taxable year so as to qualify intangible drilling costs for tax deductions.

The same regression equation was fitted to data from January 1973 through May 1976, and to the same data from January 1973 through December 1975. A Chow test [171] using the results of the two regressions was used to test the hypothesis that the monthly activity rates observed in January through May 1976 were generated by the same process that generated the rates observed bewteen January 1973 and December 1976.

The regression equation fitted was

$$y = a_o + a_1x_1 + a_2x_2 + a_3x_3$$

where

y = rig count or footage drilled

x_1 = time

x_2 = December dummy

x_3 = January dummy

Inclusion of the dummies contributed explanatory power. Using rig counts from January 1973 through December 1975, inclusion of the dummies improved the corrected R^2 from .7469 to .7679. Using footage drilled for the same period, inclusion of dummies improved the corrected R^2 from .5589 to .6966. A Durbin-Wilson statistic of .25 indicated severe serial correlation remained in the rig count regression errors even when dummies were used; the footage regression had a Durbin-Wilson statistic of 2.03.

It was possible to reject at the .001 level the hypothesis that the regression equation fitted to rig count data generated the 1976 data. In fact, to six places the probability that hypothesis was true was zero.

It is not possible to reject the hypothesis that the footage drilled data were generated by the regression equation at the .05 level, but it was possible to reject at the .10 level.

FOOTNOTES

1. Economic Report of the President, January 1973, pp. 51-52.

2. "History of Petroleum Price Controls," Historical Working Papers on the Economic Stabilization Program, Part II. (Washington: GPO) 1235.

3. "History of Petroleum Price Controls," p. 1232. M. Adelman points out that because of the complex process by which tickets were traded, no precise estimates of their "price" can be made. He recognizes $1.25 as a convenient "rule of thumb". See Maurice Adelman, The World Petroleum Market, Baltimore, 1974.

4. FEA, Project Independence Final Task Force Report on Oil, November 1974, p. II-6.

5. Ibid, p. II-1.

6. Testimony of John Hill, Deputy Administrator, Federal Energy Administration, in "Oil Price Decontrol," Hearings before the Committee on Interior and Insular Affairs, U.S. Senate, September 4 and 5, p. 170.

7. There are no universally accepted conventions for describing the structure of the petroleum industry. Some focus on sales of gasoline under a national brand name, others on self-sufficiency in crude oil production, and others on size of refining capacity. The FTC, adopting the first definition, identifies 16 major, integrated firms:

Exxon	Shell
Texaco	Standard (Indiana)
Standard (California)	Gulf
Mobil	Atlantic Richfield
Sun	Union
Standard (Ohio)	Phillips
Continental	Marathon
Cities Service	Getty

There are roughly 100 non-major refiners.

8. The EPAA provided for special treatment of two classes of refiner: "small" refiners, defined as businesses which owned less than 175,000 barrels per day of refining capacity, and "independent refiners" defined as refiners that controlled less than 30 percent of their crude oil inputs. By these definitions, 15 firms are not classified as small or independent, and 7 are currently classified as large independents.

9. Mason Willrich, Administration of Energy Shortages: Petroleum and Natural Gas, Ballinger: Cambridge, Massachusetts, p. 113.

10. M. Adelman, The World Petroleum Market, Baltimore: 1974, p.70.

11. Federal Trade Commission "Staff Report on the Effects of Decontrol on Competition in the Petroleum Industry," "Oil Price Decontrol Hearings," September 5, 1975, pp. 373-374.

12. FTC "Staff Report on the Effects of Decontrol".

13. Statement of John Hill, Deputy Administrator, Federal Energy Administration, September 4, 1975, in "Oil Price Decontrol" Hearings before the Committee on Interior and Insular Affairs, United States Senate, GPO, 1975, p. 172.

14. Ibid, p. 154.

15. FTC "Staff Report on Effects of Decontrol", p. 366.

16. Federal Trade Commission "Preliminary Staff Report on the Investigation of the Petroleum Industry," Printed by the Committee on Government Operations, U.S. Senate, July 12, 1973, p.39.

17. Mason Willrich, op. cit., p. 113.

18. Testimony of John Hill, p. 167.

19. William Johnson, Richard Messick, S.Van Vector, F. Wyant, "Competition in the Oil Industry," in "The Petroleum Industry: Vertical Integration," Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U.S. Senate, January and February, 1976, p. 26.

20. FEA "Petroleum Market Shares, Historical Report on Refiners and Importers of Motor Gasoline 1972 through 1974," October, 1974, p. 10.

21. Johnson et al, op.cit., p. 19.

22. "History of Petroleum Price Controls," quoted on p. 1240.

23. "History of Petroleum Price Controls," p. 1241.

24. "History of Petroleum Price Controls," p. 1242.

25. "History of Petroleum Price Controls," p. 1242.

26. "History of Petroleum Price Controls," p. 1245.

27. "History of Petroleum Price Controls," p. 1242-1245.

28. Johnson, "Impact of Price Controls," p. 107.

29. EPAA Sec. 4(a).

30. House Report 93-628, p. 12.

31. House Report 93-628, p. 12.

32. House Report 93-521, p. 6.

33. EPAA, Sec 4(b) (1).

34. House Report 93-531, p. 9.

35. House Report 93-628, p. 22.

36. EPAA Sec 4(b) (1) (F).

37. House Report 93-531, p. 19.

38. House Report 93-628, p. 25.

39. House Report 93-628, p. 26.

40. EPAA Sec. 4(b) (1) (H) and (I).

41. "Economic Impact of Instant Decontrol" Testimony Submitted to the Committee on Interior and Insular Affairs of the United States Senate, "Oil Price Decontrol Hearings," Friday, September 5, 1975.

42. Higher Oil Prices and World Economy: The Adjustment Problem, ed. Edward R. Fried and Charles L. Schultze, Brookings Institution, Washington, D.C., 1975.

43. House Report 94-340, p. 5.

44. Ibid, p. 6.

45. House Report 94-340, p. 7.

46. House Report 94-340, p. 8.

47. "Energy Policy Options" Report of the Task Force on Energy to the Committee on the Budget, U.S. Senate, September 25, 1975, p. 9.

48. "Oil Price Decontrol," Hearings Before the Committee on Interior and Insular Affairs, September 4 and 5, 1975, Serial No. 94-23, p. 330.

49. Recovery: How Fast and How Far?, Congressional Budget Office, Setpember 17, 1975.

50. CBO, p. 57.

51. Senate Report 94-1119 "Energy Conservation and Production Act," p. 54-55.

52. Senate Report 94-1119, p. 56.

53. Senate Report 94-1119, p. 57.

53a. Senate Report 94-1119,

54. 10 CFR 212.73(b).

55. William Carson, FEA, Personal Communication, 8-31-76.

56. FEA Monthly Energy Review, July 1976, p. 62.

57. Technically, the supply price for the refining industry with crude oil price controls can be represented as a markup (assumed constant for simplicity), on the cost of crude inputs. For quantities of refined product output between zero and the amount of old oil available, the supply price will be $5.03 plus the markup. For any larger quantity, the supply price is the price of uncontrolled oil (including imports), say $11 per barrel plus the markup. As long as demand at $11 per barrel plus markup is greater than the amount that can be supplied using old oil alone, the market price will be $11 plus markup. Changing the price of old oil from $5.03 to $11.00 per barrel would not change the market price. Without price controls, all crude oil would sell at a single price, equal to that price of imports.

58. Doris Dewton, FEA, Personal Communication.

59. "History of Petroleum Price Controls," pp. 1306-1307.

60. Statement of Frank Zarb, Administrator, FEA, May 19, 1975, in "Oversight - FEA Programs," Hearings before the Committee on Interior and Insular Affairs, U.S.Senate, Serial No. 94-16, p. 526.

61. 10 CFR 211.67 (R).

62. FEA Monthly Energy Review, July 1976, p. 67.

63. 41 Federal Register 9391, March 4, 1976.

64. Statement of Frank Zarb. p. 499.

65. Ibid., pp. 501-508.

66. Ibid., pp. 519-520.

67. Ibid, p. 521.

68. 41 Federal Register, March 3, 1976.

69. 10 CFR 211.51.

70. Statement of Frank Zarb, pp. 544-545.

71. FEA, "Preliminary Findings and Views Concerning the Exemption of Motor Gasoline from the Mandatory Selection Program," November 16, 1976, p. 31.

72. Oral Communication, A. Lockard, FEA, 8-16-76.

73. "History of Petroleum Price Controls," p. 1315.

74. FEA "Quarterly Report: Energy Information, Second Quarter, 1976," p. 15.

75. FEA Monthly Energy Review, July 1976, p. 50.

76. The accounting in this example is extremely simplified. No account is taken of taxes, in particular, and the special tax treatment of the industry would change many relative magnitudes although not the main point.

77. To be complete the "cost" of oil production should include a "user cost" term, which reflects the increased value that a barrel of oil in the ground would have when extracted in the future.

78. Subject to the usual caveat regarding transport and quality differentials.

79. "History of Petroleum Price Controls," pp. 1260 and 1308-1310.

80. Oral Communication, William Carson, FEA, 8-31-76.

80a. See, for example, J. Stiglitz, "The Efficiency of Market Prices in Long Run Allocations in the Oil Industry" in G. Brannon, ed. Studies in Energy Tax Policy, Ballinger: Cambridge, Massachusetts, 1975, p. 59.

81. These assumptions are rough approximations to an FEA analysis of the the economics of an enhanced recovery technique called "miscible augmented water flood," found in "Review of Secondary/Tertiary Recovery," Draft, June 18, 1975, in "Energy Conservation and Oil Policy Part 1," Hearings Before the Subcommittee on Energy and Power of the Committee on Interstate and Foreign Commerce, U.S.House of Representatives, Serial 94-17, pp. 975-978.

82. "Review of Secondary/Tertiary Recovery of Crude Oil."

83. J.W. Devanny III, "The Estimated Recovery Potential of Convential Source Crude Oil," Prepared for EPA, Contract No. 68-01-2445, May, 1975.

84. FEA Monthly Energy Review, July 1976, p. 64.

85. FEA 1976 National Energy Outlook, p. 64.

86. E. Hudson and D. Jorgenson estimate a crude oil price elasticity of -.36 in their article "U.S. Energy Policy and Economic Growth, 1975 -2000," Bell Journal of Economics and Management Science," Vol. 5, No. 2, Autumn, 1974, p. 505.

87. Paul Davidson, L. Falk and H. Lee, "Oil: Its Time Allocation and Project Independence," in Brookings Papers in Economic Activity, Vol. 2, 1974, p. 438.

88. Based on 1980 demand projections at various prices reported in FEA's National Energy Outlook - 1976.

89. Based on data provided by FEA Entitlements Program.

90. Oral Communication, William Carson, FEA.

91. FEA, "Trends in Refinery Capacity and Utilization," June 1976, p. 7.

92. Exxon Testimony, FEA Public Hearing on Refining Capacity, December 9, 1974.

92a. Ibid.

93. Exxon, Oral Communication, 7-20-76.

94. Mark Frederickson, FEA, Oral Communication, 9-2-76.

95. FEA "Trends in Refining Capacity and Utilization," p. 8.

96. Statement of Frank Zarb, pp. 549-551.

97. Ibid. p. 990.

98. "History of Petroleum Price Controls," pp. 1313-1315.

99. Richard Mancke, Performance of the Federal Energy Office, American Enterprise,Washington, D.C., 1975, pp. 4-6.

100. George Perry,"The United States," in Fried and Schultze, op.cit., p. 85-86.

101. Mancke, op.cit., pp. 11-13, G, Perry, op.cit., p. 86.

102. Prepared Statement of F.M. Scherer, Federal Trade Commission, Bureau of Economics, in "The Petroleum Industry - Vertical Integration," Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, United States Senate, January 30, 1976, p. 2141.

103. In "Oil Price Decontrol Hearings," pp. 9-143.

104. Federal Register 4932, February 3, 1976.

105. FEA Monthly Energy Review, July 1976.

106. 41 Federal Register 4940, February 3, 1976.

107. 41 Federal Register 15566, April 13, 1976, Part V.

108. 41 Federal Register 15569.

109. 41 Federal Register 15570.

110. 41 Federal Register 15566, April 13, 1976.

111. Oil and Gas Journal, March 8, 1976, p. 27.

112. 41 Federal Register 15569.

113. 41 Federal Register 27730-27732, July 6, 1976.

114. Oil and Gas Journal, November 1976, p. 40.

114a. Ibid.

115. 41 Federal Register 13901, April 1, 1976.

116. 41 Federal Register 13901, April 1, 1976.

117. 41 Federal Register 13901, April 1, 1976.

118. Data supplied by FEA entitlements program.

119. 41 Federal Register 7131, February 17, 1976.

120. 41 Federal Register 20392-20395, May 18, 1976, and Oil and Gas Journal, May 24, 1976, p. 36.

120a. 41 Federal Register 20393, May 18, 1976.

120b. 41 Federal Register 20392-3, May 18, 1976.

121. 41 Federal Register 13879, April 1, 1976.

122. Oil Daily, May 21, 1976, p. 4.

123. 41 Federal Register 15330, April 12, 1976, 41 Federal Register 18304 May 3, 1976, 41 Federal Register 19110, and May 10, 1976.

124. EPAA 12 (d) (1) (A), EPAA 12(d) (1) (B) and EPAA 12 (d) (2).

125. "Findings and Views Concerning the Exemption of Residual Fuel Oil from the Mandatory Petroleum Allocation and Price Regulations," March 29, 1976, Federal Energy Administration, Washington D.C. pp. 1-4.

126. Ibid, p. 69.

127 Ibid, p. 100.

128. 41 Federal Register 7127, February 17, 1976.

129. 41 Federal Register 13900, April 1, 1976.

130. 41 Federal Register 13900, April 1, 1976.

131. 41 Federal Register 24517.

132. Federal Register July 22, 1976.

133. Oil Daily, Friday, July 2, 1976, p. 1.

134. Oil Daily, Friday, August 6, 1976, p. 32.

134a. Oil Daily, May 17, 1976, p. 32.

135. Monthly Energy Review, Federal Energy Administration, July 1976, p. 66.

136. FEA, "Monthly Report on Gasoline Service Stations Market Shares -- May 1976."

137. FEA "Preliminary Findings and Views Concerning the Exemptions of Motor Gasoline," pp. 66-68.

138. FEA, Project Independence Final Task Force Report on Oil, November, 1974, p. IV-2.

139. Oil and Gas Journal, November 1, 1976, p. 40.

140. Oral Communication, Wiliam Carson, FEA.

141. Paul Davidson, Testimony in "Seminar -- Energy Policy," Committee on the Budget, U.S. Senate, September 1975.

142. S.A. Marglin "Economic Factors Affecting System Design" in Design of Water Resource Systems, Cambridge, 1962, pp. 179-184.

143. Oil and Gas Journal, October 20, 1976.

144. FEA, Monthly Energy Review, July, 1976.

145. Oil and Gas Journal, September and October, 1976.

146. FEA, 1976 National Energy Outlook, Appendix C.

147. Oil Daily, July 20, 1976, p. 1.

148. 41 Federal Register 4939, February 3, 1976.

148a. Oil and Gas Journal, November 1, 1976, p. 40.

149. Oil Daily, February 13, 1976, p. 1.

150. Oil and Gas Journal, September 20, 1976, p. 115.

151. Data supplied by FEA Entitlements Program

152. Based on refiner volume and cost data supplied by FEA entitlement program.

153. 41 Federal Register 13899, April 1, 1976, and 41 Federal Register 24518 and 24521, June 16, 1976.

154. Oil and Gas Journal.

155. "History of Petroleum Price Controls," pp. 1262-1264.

156. Federal Trade Commission, "Preliminary Staff Report on Investigation of the Petroleum Industry".

157. FEA "Trends in Refinery Capacity and Utilization," p. 2.

158. Oil and Gas Journal, April 5, 1976, April 7, 1975, and April 1, 1974.

159. Testimony of Frank Zarb in "Extension of Federal Energy Administration," Hearings before the Committee on Government Operations, U.S. Senate, April and May 1976, p. 150.

160. Budget of the United States, Fiscal Year 1977, Appendix, p. 726.

161.

162. Oil and Gas Journal, October 18, 1976, pp. 48-49.

163. William F. Cockrell, Jr., "Federal Regulation of Energy: Evolution of the Exceptions Process," Administrative Law Review, p. 241.

164. Cockrell, p. 244.

164a. Testimony of John Love, President, Colonial Oil Co., in "Extension of the Federal Energy Administration", Hearings before the Committee on Government Operations, U.S. Senate, May 4, 1976, pp. 241-248.

165. EPAA Sec. 4(a) (1) (A), EPCA Sec 8(b) (1) (B).

166. Testimony of Thomas Kauper, Assistant Attorney General for Antitrust in "Oil Price Decontrol" Hearings before the Committee on Interior and Insular Affairs, U.S. Senate, September 5, 1975, pp. 210-214.

167. Congressional Budget Office "Recovery: How Fast and How Far?, September 17, 1975, pp. 64-65.

168. Under current regulations the 21¢ goes to refiners. It would be a more effective stimulus to domestic crude oil production if it went to producers.

169. The statistical analysis was carried out by my Caltech colleague, Forrest Nelson, though responsibility for its interpretation is mine.

170. Data from FEA Monthly Energy Review, July 1976, p. 50.

171. J. Johnston, Econometric Methods (2nd edition), (McGraw-Hill, New York, 1972) p. 207.